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Engineering News-Record

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Using Aerial Photographs in Topographic Mapping

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Sewage Treatment Trends in England

BY KARL IMHOFF

Translated by Gordon M. Fair

Spanning 170 ft., a new record, this unique reinforced concrete truss in Pierce County, Wash., utilizes wide shallow slabs as chords and has its web members pierced by sidewalk openings.

"Build Safer Roads"

Installation of Armco Metal Cribwall in Idaho permits shift in road to avoid dangerous, sliding slopes. Note how wall is built to fit curve.

"BUILD safer roads" is America's cry today! Road widening and straightening—two important methods—frequently involve restricted right of way where some means must be found to stabilize the cut and fill slopes. And a retaining wall is the answer.

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What About Incentives?

THE year now dawning promises to produce a flood of debate on schemes to abate the social and economic evils that beset mankind. The presidential campaign of 1932 introduced a New Deal; the campaign of 1936 is likely to involve an amazing variety of deals, some new, some old, some for better and some for worse.

No thinking man shies from a new idea or a new plan just because it is new. He knows that new plans are necessary to meet the changing needs of a fast-moving people; new mechanisms are required to help us deal with new conditions and the problems to which they give rise. But many of our people forget that the function of any mechanism is merely to convert endeavor into accomplishment; they do not distinguish between a mechanism and the endeavor that drives it. To them an economic or social program is an end in itself, an accomplishment, a solution of a problem.

Of course, it is no such thing. Such a plan is like the chassis of an automobile. However skillfully designed, that chassis, without two essentials, is but a "load of iron." It must have some gas and an electric spark; one supplies the energy, the other activates that energy. It is these two that make the chassis productive, a useful tool rather than a dead assemblage of inert materials.

So it is with all human effort. No organization or plan, whether governmental or industrial, is more useful than the dead chassis until we apply to it the energy of human effort. Every executive knows that until he has found the right men and inspired them by appropriate incentives the best organization plan is but a scrap of paper. Human effort, after all, is the motive power of accomplishment.

WHAT is true of the individual organization is true of an economic system. Doubtless a committee of experts could formulate an economic plan that would be perfect in balance and coordination, but—*would it work?* Or more properly, would it *be worked?*

The answer to that question cannot be found in the mechanics of the plan itself; it will depend wholly on whether or not men will pour their mental and physical energies into it. However perfect in conception or planning, it will accomplish nothing unless they do, because it is their driving power that makes the economic machine useful. And if we would generate that kind of power we must take most careful account of incentives. Neglect of this factor disqualifies many of the new schemes.

Whatever may be the defects and failures of the existing mechanism and however insistently these may cry out for reform, we must take care that in correcting them we do not destroy the incentives that activate men to productive effort. When we violate their sense of property, or tamper with their familiar system of compensation, whether wages, profits or interest, when we encourage a leaning toward dependence rather than self-support and put a premium on the obligation of the community to the individual rather than on that of the individual to the community, we dull those incentives which insure the sustained flow of energy that is so necessary to keep our economic and social machinery at work.

THIS does not mean that more effective incentives never will be developed or that men never will respond to any except those they now understand. But the fact remains that at any given time we dare not supersede those which they do understand and to which they do respond until they can have some reasonable assurance as to the efficacy of the substitutes.

Most of the plans that will be discussed so hotly during the coming months take for granted that men will pour into them the same productive effort that they now apply to more familiar processes. But this is pure assumption. As each of us becomes involved in the discussion of such proposals, we shall do well constantly to check them, not alone by the principles of abstract reason and logic but also by these very practical tests: what incentives do they provide to insure the flow of human energy required to make them work, and what is the prospect that the average man will respond adequately to those incentives?

Willard Chevalier

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In the News:

SAN DIEGO VOTERS at the recent election rejected a $2,500,000 bond issue, the proceeds of which were to be used for remodeling school buildings to earthquake-proof standards.

THE FIFTIETH ANNIVERSARY of the Westinghouse Electric & Manufacturing Co., will be celebrated on Jan. 8 by a family gathering of its 40,000 employees made possible by short-wave radio. In Pittsburgh, where the program will originate, some 12,000 employees will be present in person.

THE TOWN OF HILO, HAWAII, is threatened with a water shortage, but not from one of the normal causes; a stream of lava from the crater of Mauna Loa is slowly approaching the valley in which the town reservoir is located, endangering the source of supply. Army bombers have attempted to divert the flow by dropping bombs on the edge of the lava stream, but it is not known yet whether they will be successful.

CHANGES IN THE LEVEE at New Orleans where the river swings past the high point on which the old French quarter is located have made necessary the reconstruction of the famous old French market. The buildings making up the market have been in need of repair for some time, but local sentiment has opposed the major changes that now are to be undertaken.

TOLEDO starts the new year with a city-manager form of government. Chosen as first city manager is John N. Edy, assistant director of the federal budget and formerly state highway engineer of Montana, as well as city manager of Berkeley, Calif., Flint, Mich., and Dallas, Tex.

LARGEST PWA HOUSING JOB, Ten Eyck Houses in the Williamsburg section of Brooklyn will receive an official start on Jan. 3, when Secretary Ickes and other officials turn a shovel of dirt. Demolition of the slums on the site is practically complete.

THE FLORIDA CANAL is not a threat to south Florida water supply, according to the report of the special board of geologists and engineers appointed by the War Department. Wells near the canal may have to be deepened because of a lowering of the groundwater level.

In This Issue:

WATER FLOWING in steep chutes such as are used occasionally for spillways or in irrigation ditches develops flow characteristics that are quite different from those in normal channels. As knowledge of these characteristics is essential to the correct design of chutes, the U. S. Bureau of Reclamation undertook a study of them. That study is reported in this issue by E. W. Lane, now professor of hydraulic engineering at the University of Iowa.

ENGLISH ENGINEERS pioneered in the treatment of sewage and perfected elaborate systems for very complete treatment while this country was still depending upon dilution as the principal means of sewage disposal. In recent years, however, development of the art has been rapid in this country, and, though based on British precedent, has departed from it in many respects. For that reason the comment on current British practice by Karl Imhoff, noted German authority on sewage disposal, will be found of interest to American engineers.

RAPID-TRANSIT LINES that are being installed on the Philadelphia-Camden suspension bridge will drop down into subway in Camden. As a consequence, several hundred feet of the bridge approach had to be underpinned and supported on the subway roof. The meticulous and successful procedure by which this was accomplished is described by the PWA inspector on the work.

A REINFORCED-CONCRETE-TRUSS highway bridge of 170-ft. span has been built near Tacoma, Wash., as a result of comparison of the cost of steel and concrete. By a unique design the cost of the concrete truss was brought below that for steel.

THE BUREAU OF BRIDGES of the state highway department of Illinois has been enlarged considerably to handle the unusual load of federal work added recently, also to revise completely the highway department's standard designs in the light of new developments.

WIDE INTEREST in the possibilities of rigid frames in bridge work have resulted in many efforts to simplify design procedure. In this issue C. D. Williams outlines a method developed on the New York Central Railroad.

ENGINEERS generally now recognize that survey work can be speeded up by the use of aerial photographs, but knowledge of detailed methods of application still is limited. How such photographs were used at Fairfield, Conn., is described.

A NEW TYPE of pressure cell has been developed at the University of Illinois. It measures pressure by measuring increase in frictional resistance.

ENGINEERING NEWS RECORD is a consolidation of Engineering News and Engineering Record, effected in 1917. The Contractor was consolidated with Engineering News Record in 1918. All rights to the above titles are reserved. Engineering News was founded in 1874 by George H. Frost, as The Engineer and Surveyor, which title subsequently became The Engineer, Architect and Surveyor, then Engineering News and American Railway Journal and finally Engineering News, under the editorships of D. McN. Stauffer, A. M. Wellington and Charles Whiting Baker.

Engineering Record was established in 1877 by Henry C. Meyer as The Plumber and Sanitary Engineer. The name was subsequently changed to The Sanitary Engineer, Engineering and Building Record, and, finally, to Engineering Record. During his ownership of the paper Mr. Meyer was directly responsible for the editorial policy. John M. Goodell became editor of the paper in 1902 and was succeeded in 1913 by E. J. Mehren.

E. J. Mehren became editor of Engineering News-Record at the time of the consolidation in 1917, and was succeeded by Frank C. Wight in 1924. In July, 1928, F. E. Schmitt was appointed editor.

Cities Organize in Safety Drive
COUNTRY ALARMED OVER MOUNTING AUTO DEATHS
Civic Leaders Aroused
Two Drivers Get Stiff Fine; Jailed
Legislature To Pass New Driving Law

NATION DECLARES WAR ON ACCIDENT TOLL

White Concrete Markers HAILED AS AID IN SAFETY DRIVE

"Keep in your lane!" say these Atlas White Concrete Traffic Markers on the Saugus River (Point of Pines) Bridge in Massachusetts. Center markers 8-inch wide. Broken markers 6-inch wide. Markers built on concrete base as curbing with asphalt top applied later. Installed for Massachusetts State Highway Dept. by C. J. Maney Construction Co., Boston.

● Here's a statement that's hard to believe:—In the last fifteen years 144,579 *more* Americans have been killed in automobile accidents than were killed in all the wars of our history!

Most of the fault must of course be laid smack in the laps of reckless drivers. But, despite earnest efforts to curb reckless driving, highway and traffic officials realize that what solution there is to the problem lies in making streets and highways as fool-driver proof as possible.

Permanent white concrete traffic markers are one thing officials have found helpful. These white concrete markers, made with *white* portland cement, combine constant visibility with economy. They are not merely surface markers—they are built right into the pavement—asphalt, brick or concrete. They can't be worn away. They never fade out. They are always white—always easy to see. Once in, they're in for good. We'll be glad to send you complete information. Address Universal Atlas Cement Co. (United States Steel Corporation Subsidiary), 208 South La Salle Street, Chicago.

Help Build Safety into Streets and Highways with

ATLAS WHITE TRAFFIC MARKERS

Made with Atlas White Portland Cement—Plain and Waterproofed

ENGINEERING NEWS-RECORD

January 2, 1936

FIG. 1—COMPLETED STRUCTURE of new McMillin Bridge near Tacoma, Wash. Reinforced-concrete main span, 170 ft. long, provides largest practical water opening for Puyallup River floods.

Through Concrete Trusses, 170 Ft. Long Used on Low-Cost Highway Bridge,

Unique structure near Tacoma, Wash., built to replace old steel bridge, is longest concrete truss or beam span in United States —Sidewalks accommodated by openings through truss members

By W. E. Berry and Geo. Runciman
Former Pierce County (Wash.) Engineer and President, W. H. Witt Co., Respectively

THE recently completed McMillin Bridge, 15 miles southeast of Tacoma, Wash., has as its main span the longest reinforced-concrete span, exclusive of arches, that has been built to date in the United States. It employs a through truss of novel design whose breadth and stiffness are such that lateral bracing of the trusses above the roadway is dispensed with. Sidewalks on both sides of the roadway are neatly handled by running them through the trusses on their longitudinal center lines. A most important feature of the design is its simplicity from a construction standpoint. The bridge was built of concrete because alternate bids taken on designs of both structural steel and concrete showed the concrete bid to be $826 less than the lowest bid on steel.

During the winter of 1933-34 a flood in the Puyallup River undermined an abutment of the old 150-ft. steel span, known as the McMillin Bridge, between the towns of Sumner and Orting in Pierce County, Wash. The highly precarious condition in which the bridge was left, as well as its narrow 16-ft. roadway, made a new bridge necessary. Like all rivers in the Puget Sound Basin, the Puyallup is subject to frequent severe floods, and bridges in its lower valley require the largest practical waterways and so must be of through type.

For the new bridge, which adjoins that of a branch of the Northern Pacific Railway, it was decided to increase the span to 170 ft. and to provide also short 20-ft. approach spans at both ends. The piers were taken down about 15 ft. below the ground where they are supported by steel H-piles.

Consideration of various suggestions advanced led to plans being prepared and alternate bids being taken on designs of structural steel and reinforced concrete. The steel layout was of standard type, commonly used for light highway work. It provided a roadway 24 ft. wide from curb to curb, with a lateral clearance of 25 ft. 6 in. between trusses and a vertical clearance of 15 ft. below the top lateral system. It had no sidewalks. The concrete layout had a 22-ft. roadway (curb to curb), 24-ft. clearances between trusses, unlimited vertical clearance, and 3-ft. sidewalks on both sides of the bridge. Since money received from state gas-tax funds was used in the work, plans for both designs were approved by the bridge division of the Washington state highway department.

Bids were opened on Aug. 23, 1934. Six bids were offered on the steel design, and only one on the concrete. The

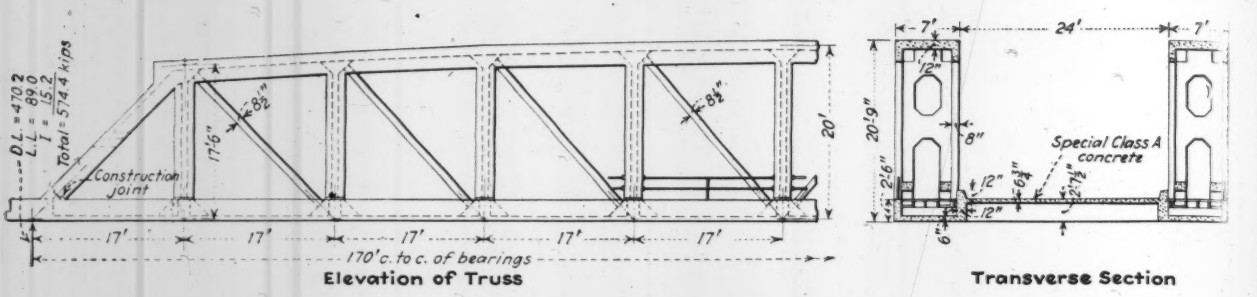


FIG. 2—ELEVATION and cross-section of through concrete truss span, the longest in the United States. Design provides for eliminating lateral bracing of trusses above the roadway.

lateness of the season and the hazard of fall floods deterred several contractors from quoting on the concrete. The steel bids for the main span and approach spans, constructing and maintaining temporary detour bridge, removing old bridge, etc., ranged from $36,738 to $48,250. The lowest bidder on steel also submitted the concrete bid of $35,912. As this was $826 lower than the steel bid and as there were maintenance advantages as well, the contract was awarded for concrete.

Work was started in September after the old span had been shifted downstream 32 ft. and had been provided with wood approaches to serve as a detour during construction. A heavy flood in October caused the work to be shut down for the winter. It resumed in April. The bridge was opened to traffic last September.

Design assumptions

In designing this bridge it was assumed that: (1) Joints of the trusses were free and without restraint; (2) the trusses were loaded axially; and (3) with the rich concrete employed, cracks in the concrete encasement of tension members would be of no practical significance.

Concerning (1) it should be said that the diagonal members were not given their concrete encasement until all shoring had been removed and they were subjected to practically their full stress by the dead load; that construction joints at the top and bottom of the verticals offered opportunity for slight elastic adjustments; that it was anticipated that deflections would be slight; finally, that on completion of the bridge a few fine cracks in the upturned outer flanges of the bottom chords—cracks for which ordinary shrinkage in the concrete may have been largely responsible—were the only indications of impropriety in an assumption which was here quite as convenient as it is in the case of joints in riveted steel trusses.

Assumption (2) departs from actuality in the fact that although 60 per cent of the dead load is in the trusses, the remaining 40 per cent is in the roadway. This roadway dead load, together with the live load, is delivered to the inner side of the trusses. This eccentricity is real and unavoidable and is not to be circumvented merely by designing the floor beams on an assumed span c. to c. of trusses. Recognizing this condition, the reinforcement of the panel-point floor beams was extended to the outer side of the trusses, diagonal steel was provided over the doorway openings in the verticals, and then the assumption was made.

The validity of the third assumption is attested by the condition of tension members in a considerable number of through tied concrete arch bridges which have in the past ten years been built in the northwest.

Loading and design details

The bridge is designed for H-15 loading, A.A.S.H.O., with 30 per cent impact on floor slabs and 16 per cent on trusses.

The wide trusses would have greatly increased the up and downstream dimensions of piers constructed as a unit in conventional manner. Consequently, the equivalent of individual pier shafts was built for each truss, and these companion shafts at each end of the span were joined at their tops by deep connecting diaphragms. To save weight and concrete, the pier shafts, which are of rectangular section with truncated corners, are hollowed with two 3-ft.-diameter circular shafts, from top of base to a point 3½ ft. below the truss seat. Steel H-piles extend an average length of 25 ft. below the bottom of the footings. The foundations at the north end proved to be softer than anticipated, and therefore additional wood piles were driven under each shaft, and the steel piles were increased in length to 40 ft.

The length of span required that dead load be kept to a minimum. Since the standard Class A mixture for bridge decks in Washington employing 1.81 bbl. of cement per cu.yd., is assumed to develop a cylinder strength of 3,000 lb. at 28 days and is permitted a maximum stress in flexure of 1,000 lb. per sq.in., the use of higher stresses logically required a richer mix of concrete. Therefore, in the deck and in the top chord of the trusses a 2-bbl. mix was used with a flexural working stress of 1,200 lb. per sq.in. and a direct stress of 900 lb. per sq.in. Elsewhere in the span Class A concrete was employed. A maximum-size aggregate of 1½ in. was used everywhere except in piers, which used 3-in. aggregate.

In elevation the trusses are of Pratt type, with vertical web members in compression and diagonals in tension. The span is 170 ft. c. to c. of bearings, divided into ten panels of 17 ft. The top chord is curved, the height c. to c. of chords at the first panel from the end is 17½ ft. and at midspan 20 ft.

In section the novelty of the truss is revealed. The top chord is 12-in. slab, 7 ft. wide, having 8-in. flanges at its edges, extending 18 in. downward from the bottom of the slab. The bottom chord is a 6-in. slab with similar flanges turned upward. The verticals are 8-in. wall sections holed out as shown in one of the accompanying views, with 8-in. flanges at both sides to give an overall dimension of 24 in. The diagonals are in pairs in each panel, framing into the top and bottom chords and into the verticals through large 45-deg. fillets or brackets.

All tension members are formed of reinforcing bars, of intermediate-grade steel. Bottom chord and some diagonal bars are 1½ in. square. On account of the long lengths required, welding of chord steel was necessary. Welds were made by butting the bars, placing 2¼x½ x9-in. plates on the sides, and making four ⅜-in. fillet welds, top and bottom, at the junction of the plates and bars. Midspan bars which did not have to extend through to the supports were terminated by extending them at least 5 ft. beyond the panel point where they ceased to be needed, and then welding them to adjoining bars. At the end joints the chords were made of full solid section to the top of the upstanding flanges, i.e. 30 in. deep. The longitudinal bars were anchored by bending them in a full semicircular sweep up to the top of the chord and then returning them downward to the bottom at an angle of about 30 deg. directly beneath the main end posts of the truss.

Anchorage of the diagonals is obtained by bond only. Embedment of at least 40 bar diameters from the point at which the bars enter into the large fillets is everywhere provided. Addi-

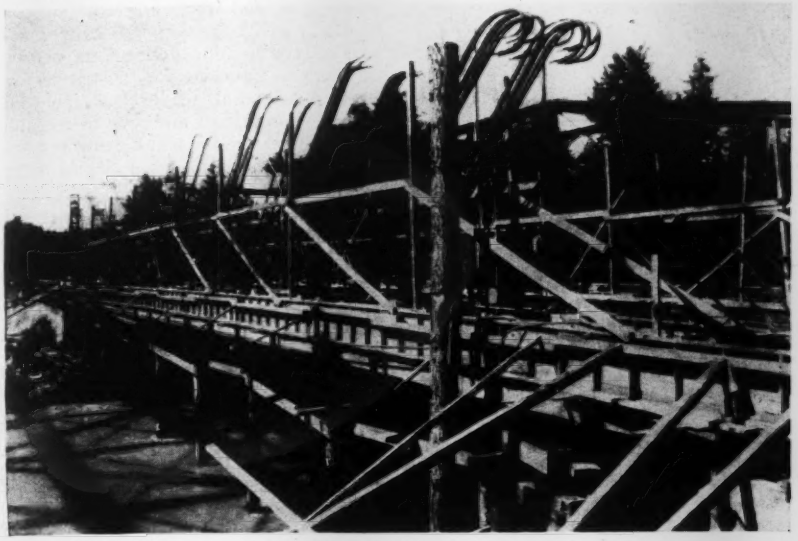


FIG. 3—REINFORCEMENT of truss diagonals, which are placed in pairs in each panel and frame into the top and bottom chords and into the verticals through large 45-deg. fillets or brackets.

tional anchorage is obtained from the large bends and sweeps at the ends of all diagonals and from the clamping compressive effect which the pressure in the verticals produces. At the end of the top chord where junction with the end posts is made, the joint is enlarged to provide room for the exceptionally large full hooks in which the bars of the last diagonals terminate.

An additional half-inch of thickness was added to the floor slab for wear. As chains on automobile tires are seldom, if ever, required anywhere along the Pacific Coast, wear on rich-mix bridge floors is practically non-existent, but in conformity with standard specifications it is carefully guarded against.

Besides the half inch of extra thickness required on the floor slabs for non-existent wear, the amenities of conventional design were further observed by including an allowance in the dead load of 15 lb. per sq.ft. for surfacing, presumably to be applied when the extra concrete has worn away.

Commendable as foresight ever is in engineering work, it would seem that the gain in strength which comes to concrete in times subsequent to the 28-day age admitted and recognized by the specifications might safely be substituted for one or for the other or for both of the above safeguards.

The floor beams of the roadway are flush with the bottoms of the trusses. The truss verticals are simple wall sections. The top chord is a wide slab, practically horizontal, with simple marginal flange beams.

The span was given, more or less arbitrarily, a 6-in. camber, to cover deflection and to preserve as well a slight upward curvature in the bottom chord. A maximum deflection of $1\frac{7}{16}$ in. occurred at mid-span when the bridge became self-supporting.

The bridge is seated on the piers by means of steel bearings and rockers of conventional design. Had these been painted instead of being cadmium-plated as was required, they would not have cost 10c. per pound for the 8,850 lb. of metal so treated, and the concrete alternate would have shown a greater saving over the steel design than it did. Upon the removal of the falsework the panel points adjacent to the ends deflected an average of $\frac{3}{8}$ in. This deflection in the panel length of 17 ft. represents an angular change of 6 min. 5 sec., which is not a large amount. It would appear that plain steel bearing plates separated by asbestos packing as originally proposed would quite effectively have adjusted to such an angular change; they would, as shown by tests reported in *ENR*, June 25, 1931, p. 1058, have functioned very satisfactorily in allowing slight horizontal movements; and they would have been much less expensive to install, and in case of earthquake would be vastly superior structurally.

Weights and loads

The end reaction of one truss is:

	Lb.
Dead load	470,200
Live load, including impact	104,200
Total	574,400

Dead load thus constitutes 82 per cent of the total load for which the trusses are designed, and in view of the somewhat problematical nature of the impact allowance on a heavy structure of this character as well as the ample live load assumed, it is quite proper to say that for every pound of live load and impact there are 5 lb. of dead load.

What factor of safety against failure by exceeding the total design load there may be in these trusses cannot be definitely stated. However, as is generally the case, they are designed with the same maximum stresses for both dead and live loads. Probably the factor of safety is 4 or 5; but assuming it to be only 3, the following interesting relationship obtains:

Ultimate load = 3 live load + 3 dead load = 3 live load + (3) (5 live load) = 18 live load.

Then external load to be applied to produce failure = ultimate load—dead

FIG. 4—TRUSS FORMS and reinforcing. Chord steel, before concreting, is spliced by welded plates.

FIG. 5—DETAIL of first vertical, showing reinforcement and interior forms.

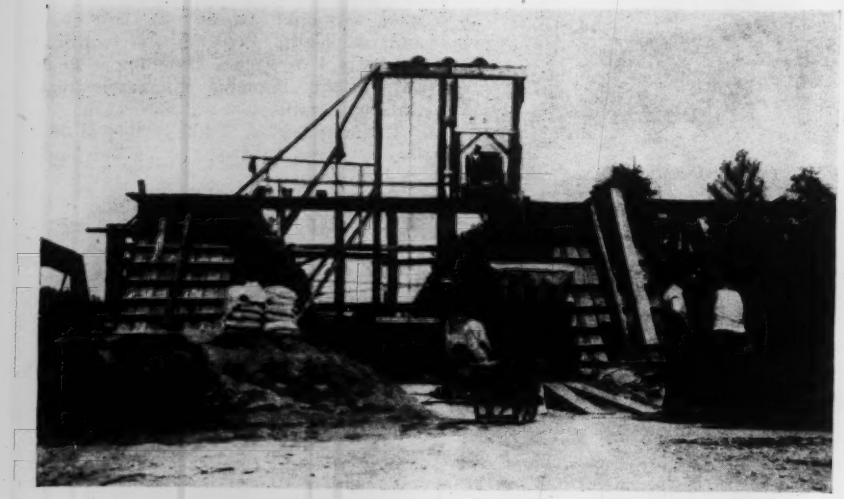


FIG. 6—CONCRETE MIXING PLANT and hoist. Mixing was performed with a 2-sack machine on the south approach span, concrete being wheeled along runways on the top chord.

load = 18 live load—5 live load = 13 live load.

If the factor of safety is greater, or if the ratio of dead load to live load is greater, then instead of the application of 13 times the design live and impact loads being required to produce collapse, a much greater load is required. For instance, with a factor of safety of 4 and a ratio of dead to live load of 6, it is 22 times the designed live and impact loads that must be applied to produce collapse. The grave apprehensions sometimes entertained lest the safety of heavy concrete bridges be jeopardized by unusually heavy trucks passing over them may be allayed or may at least be alleviated by the above considerations.

Order of construction

There were no unusual construction problems. Formwork for the deck was carried on pile bents, located at the truss panel joints. The reinforcement of the truss diagonals, anchored and bonded into the bottom chord, was supported in correct position on light wooden frames longitudinally and transversely braced while the concreting was being done. Steel for the verticals and end posts was stubbed into the concrete. Mixing was performed with a 2-sack machine on the south approach span. The entire deck—roadway and bottom chords of trusses—was placed in one continuous pour of 245 cu.yd. Concrete for the trusses was hoisted to top-chord level at the south end of the bridge and was wheeled to position on simple plank runways supported by the top-chord forms themselves, thus eliminating all trestling for runways. End posts and verticals constituted the second pour, top chords the third, and diagonals the fourth. An electrical internal vibrator was of material assistance in placement. In general, very excellent concrete was obtained.

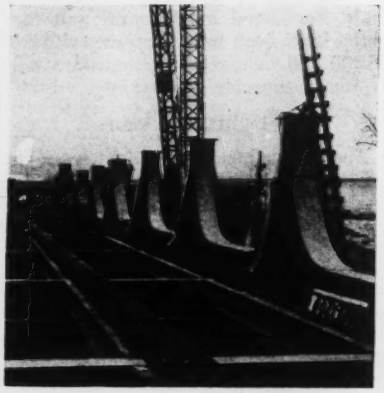
Drains were provided in each of the bottom-chord sections formed between chord flanges and panel point beams. These areas were planked from flange to flange at the level of the top of the panel point beams and thus formed the floor of the sidewalks. Light pipe handrails above the outer flange protect the pedestrian on that exposed side. With the top chords of the trusses directly overhead, no umbrellas are needed, except when winds accompany the rain.

The major features and layout of this bridge were suggested by Homer M. Hadley, regional structural engineer of the Portland Cement Association. The W. H. Witt Co., Seattle, prepared the detailed plans. The co-author of this article was Pierce County engineer at the time that the designs were prepared and the contract was awarded. Most of the construction was performed under the charge of the present county engineer, Forest Easterday. F. E. Walters was resident engineer. Dolph Jones of Tacoma was the contractor.

Vierendeel Welded Trusses Used for Dutch Road Bridge

DUTCH ENGINEERS have recently completed a welded steel Vierendeel truss bridge which adds an interesting variation to the Belgian structures described in *Engineering News-Record*, July 25, 1935, p. 117. The new bridge, described in *L'Ossature Métallique*, September, 1934, carries a highway over a railway at Nuth, Holland, on a through truss span about 175 ft. long with a 25½-ft. roadway and two outside sidewalks, each 8 ft. wide. The upper-chord outline and the floor construction are indicated as features of particular interest.

While in general practice it is usual to shape arched chords of this type of truss as true arcs, the designers of the Nuth bridge adopted a nine-sided polygon described in a parabola. This polygonal form, it is stated, is preferred by Holland government engineers for technical reasons, and also because they consider it more truly esthetic. Their argument against the true arc is that: (1) longitudinal stresses produce an additional relatively high bending moment requiring more steel; and (2) curved and generally parabolic forms require special shopwork, which is often laborious and expensive. A notable detail is the four-way welding of the lower-chord connections of the verticals to both chord and to floor and sidewalk beams and the plate cap, thus forming a pedestal on which the vertical rests and is welded. The illustration indicates this arrangement.



DECK STRUCTURE of Vierendeel truss road bridge at Nuth, Holland, showing spiral reinforcing for concrete floor and gusset pedestals for web verticals.

The floor is a concrete slab without expansion joints and 187 ft. from end to end, reinforced with spirals of ⅞-in. steel welded to the floor stringers. The sidewalk slabs are similarly constructed. The floor-slab spirals are 9½ in. in diameter and have a pitch varying in accordance with shearing stresses from about 4 to about 5 in. The floor system has no lateral bracing other than the deck slabs. The steelwork was mostly shop-assembled and welded in sections, to reduce field welding.

Recent Studies on Flow Conditions in Steep Chutes

Studies made in connection with the design of the spillway of Cle Elum Dam and the tunnels of Boulder Dam have helped to clear up some of the uncertainties in connection with flow conditions in steep channels and spillways

By E. W. Lane
Professor of Hydraulic Engineering, University of Iowa, Iowa City, Iowa, Formerly Research Engineer, U. S. Bureau of Reclamation

MORE EFFICIENT DESIGNS for steep chutes are now possible as a result of the studies made by the U. S. Bureau of Reclamation in connection with the design of irrigation water chutes and the spillways of some of its dams. In the following article the most important of the facts learned in those studies are set forth.

The formation of a boundary layer

As the water starts down the steep section of a chute the portion of it which is not close to the bottom or sides is rapidly accelerated and soon attains a high velocity. There is a narrow zone on the bottom and at the sides, however, in which the velocity adjacent to the walls and floor is zero and that at the outside of the zone reaches that of the center section. In this narrow boundary layer there is therefore a rapid increase in velocity with increasing distance from the side walls, or in other words, there is a high velocity gradient. In the side strips the flow is very turbulent and air is entrained, giving the water a white appearance, as shown in Fig. 1, which pictures the conditions in a steep chute on the Uncompahgre irrigation project in Colorado. There is a similar zone in contact with the bottom, but it is not as apparent since it is not in contact with the atmosphere, and air is therefore not entrained. This boundary layer, both on the bottom and sides, is narrow at the top of the chute but widens as the water flows down, as shown in Fig. 1. The water in the central swift-flowing portion has a relatively smooth surface, and the acceleration resulting from moving down the chute is reduced but little by the effect of friction on the sides. This central portion becomes narrower and thinner as the boundary layer increases in thickness, and if the chute is long enough a point is reached where the velocity throughout the entire cross-section is considerably retarded by side friction. When this point is reached the surface becomes rough, since the turbulent zone has extended through to the water surface.

In long chutes, changes of gradient frequently occur. These are usually formed with convex or concave vertical curves. Convex vertical curves must not be made sharper than the trajectory which the moving water would have in falling under the action of gravity. If the flume bottom is steeper, the flowing water will not follow the bottom but will leave it and rise possibly even above the tops of the side walls. In determining the shape of the trajectory for any case it is not sufficient to use the mean velocity, with a friction loss computed by one of the well-known velocity formulas, since each particle will tend to take a trajectory depending upon its individual velocity, and some of the particles will have a greater velocity and therefore will assume a flatter trajectory than the mean velocity would indicate. Since the higher velocities occur near the surface, these particles will be the ones with the flattest trajectory, and there will be few particles above them to prevent them from following their natural courses. Because the water near the surface, especially near the upper end of the chute, is retarded little by friction in the boundary layer, as previously explained, it will have a velocity nearly equal to that due to its total fall. To be sure that the flowing water will follow convex vertical curves, it is desirable that chutes be designed to be as flat or flatter than the trajectory of a projectile with an initial direction of that of the flume above the curve, and a velocity equal to that which would be produced by the total fall down to that point. In some cases, however, this may prove very expensive, and somewhat sharper curves have been used, as will be explained later.

When the vertical curve is concave, a double spiral motion is set up, similar to that which takes place in bends in an enclosed channel. This is caused by the centrifugal force, as shown in Fig. 3, which represents the pressures set up by a concave vertical curve in a rectangular flume. The depth of the water at the sides and center of the channel approaching the bend being the same, the pressures due to the weight of the water, represented by the areas *AA* and *CC* are equal. As the water flows around the concave bend the centrifugal force of the water sets up a pressure, represented by *BB* and *DD*. The radius of curvature causing these forces is the same at the center and sides of the flume, but the velocity is greater at the center, thus giving rise to greater centrifugal-force pressures at the center of the flume and a resultant centrifugal-force effect acting toward the sides. This pressure, being greater near the bottom, gives rise to a double spiral motion, as shown in the lower drawing, Fig. 3. This motion was very prominent at the concave curve in the chute of Fig. 1, as shown by the rapid movement

FIG. 1—A STEEP CHUTE on the Uncompahgre irrigation project well shows how turbulent flow develops along the side walls.

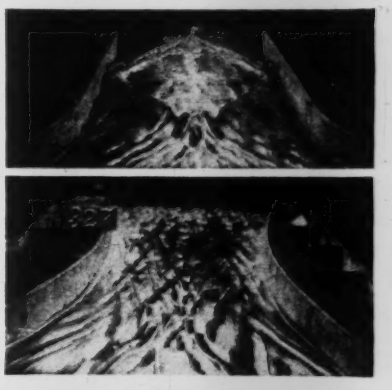


FIG. 2—DIAMOND-SHAPED FIGURES are formed by the higher waves that develop on the surface of flumes where the sides converge, as shown in the upper picture of a model of the spillway of Cle Elum Dam. By using a flume with flexible sides (lower picture) it was found possible to develop a transition section in which the flow, though still producing a complex wave pattern, produced no high waves. The shape of the contracting part of the flume exerts the greatest influence on the patterns.

of the white water from the sides across the surface in the flume below the bend.

Effects of non-uniform width

If the chute or trough is not of uniform width, a peculiar wave action is apt to result. Fig. 2 shows the conditions occurring in a model of the preliminary design of the spillway of the Cle Elum Dam in Washington. Similar diamond-shaped figures have been observed in a number of full-sized structures. It appeared as though a stream of water, of a depth considerably greater than the average in the flume, was deflected by each side of the converging section and moved across the flume to the opposite side, where it impinged on the wall and was deflected back, at the center of the flume meeting and passing through the similar stream deflected from the opposite side. The introduction of coloring matter into the water flowing down this flume, however, immediately demonstrated that the water itself flowed nearly directly down the channel, and did not follow the apparent direction at all. This proved that these ridges were not currents but merely waves that moved across the channel. The diagonal direction of the wave was due to the longitudinal movement of the water in the flume. The direction was the resultant of the motion of the wave across the flume and the movement along the flume of the water through which the wave was traveling. A comparison was made of the direction of the ripples observed in a flume of uniform width and those computed on this basis. The cross waves were assumed to move at right angles to the sides of the flume at the wave velocity $\sqrt{gd}$, where d is the depth of the water. For depths of about 0.1 ft. or less the wave velocities seemed to be somewhat less than computed by the formula, but for depths of about 0.2 ft. or more the law seemed to hold.

The study of this wave motion was not sufficiently comprehensive to enable a complete analysis of the phenomena to be made from which a satisfactory shape of spillway with decreasing width could be computed, but by means of a model with flexible sides such a shape was worked out. It had a section contracting from 200 to 100 ft. width, and expanding to 200 ft. width again at the lower end. In it the wave pattern was complex, but gave no high waves at any point, as shown in the lower photograph, Fig. 2. It was found that the shape of the contracting part of the flume exerted a great influence on the wave patterns set up, but the shape of the expanding section had little effect.

In the design of chutes, and in fact, in all structures in which the water moves at less than critical depth, it should be remembered that changes in the horizontal direction of flow are apt to be difficult to make, and therefore should be avoided if possible. They should never be made unless model tests have proved that the desired results will be secured. Where the depths are greater than the critical, changes of direction can be made with comparative ease. This is most easily visualized by a conception that is frequently brought out in European literature but does not seem to have been largely used in this country. The critical depth of water flowing in a rectangular channel is related to velocity of flow by the formula $V = \sqrt{gd}$. The velocity of the wave motion in the channel is also $V = \sqrt{gd}$. If, in a stream of water moving at a velocity greater than the critical and therefore at a velocity greater than $\sqrt{gd}$, an obstruction is placed in a manner that would cause a wave to move up the stream, this wave can move upstream with respect to the flowing water at a velocity of only $\sqrt{gd}$, which is less than the downstream motion of the water, and therefore the wave can never have a net movement upstream.

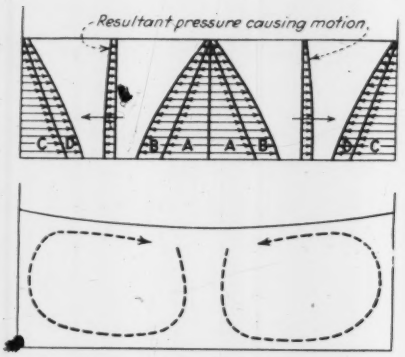


FIG. 3—CENTRIFUGAL FORCES at vertical curves set up pressures, as shown diagrammatically in the upper line, that result in a double spiral motion, as indicated in the lower line.

This conception explains why water moving at greater than critical velocity is so hard to control. It is also a valuable aid in visualizing the reason for many other phenomena of fast-moving water in channels—for example, why the level of the water below a section of a flume in which the velocity is greater than the critical has no effect upon flow conditions above the critical velocity section.

Friction losses at high velocities

Data on friction losses in open channels at high velocity are scarce, and there is considerable difference of opinion regarding such losses. The problem is complicated by the inclusion of air in the flowing water, which gives rise to the condition where Q is not equal to AV, if A is the measured water cross-section, including the air. In investigating this subject for the design of the tunnel of the Boulder Dam, observations were made on the flow through a chute on the Uncompahgre irrigation project in Colorado. The profile of this structure is shown on Fig. 4. The discharge was taken from a rating curve based upon a large number of current-meter measurements. Water-surface elevations were measured by means of a point gage, the average elevation of about ten points across the surface being taken as the mean for the section. Observations of water-surface elevations for about 20 different discharges were made at a number of stations along the flume, and an elevation-discharge curve was constructed for each station. A curve of the position of the jump vs. the discharge was also plotted. From these data the profiles for various discharges in the flume were plotted, and the values of roughness

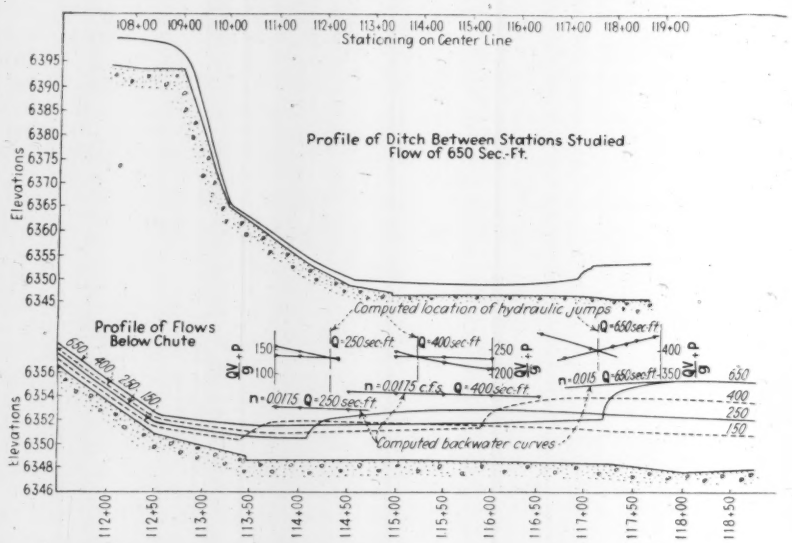

108+00 109+00 110+00 111+00 112+00 113+00 114+00 115+00 116+00 117+00 118+00 119+00
Staticning on Center Line
Profile of Ditch Between Stations Studied
Flow of 650 Sec.-Ft.
Elevations
Computed location of hydraulic jumps
Profile of Flows
Below Chute
Q=250sec.ft
Q=400sec.ft
Q=650sec.ft
n=0.0175 c.f.s. Q=400sec.ft
n=0.015 Q=650sec.ft
n=0.0175 Q=250sec.ft
Computed backwater curves
112+00 112+50 113+00 113+50 114+00 114+50 115+00 115+50 116+00 116+50 117+00 117+50 118+00 118+50

FIG. 4—SECTIONS OF A CHUTE on the Uncompahgre irrigation project used in the study of friction losses at high velocities.

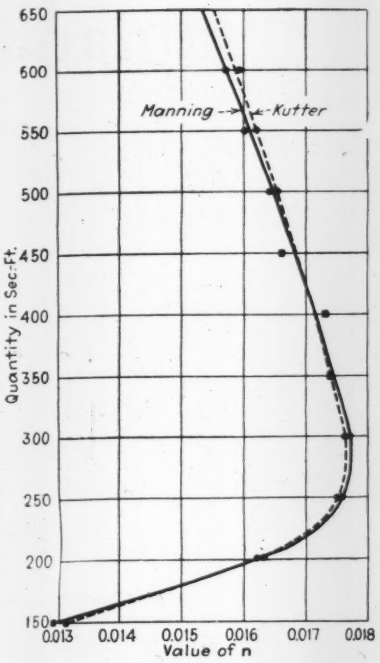


FIG. 5—ROUGHNESS VALUES for the tests section of the Uncompahgre flume as determined by the Manning and Kutter formulas.

were computed by the Kutter and Manning formulas as shown on Fig. 5. The velocity of flow in this portion of the flume is above the critical. An attempt was made to compute the roughness values for short sections, but the velocity-head errors involved in a slight inaccuracy of the observation of the water-surface levels were so great that reliable values of friction loss for short sections could not be secured. The values represented in the figure were determined from as great a length as possible, ranging from 350 to 700 ft. The roughness values are not noticeably different from those that would be expected for flows at low velocity or subcritical velocity. The bottom of the flume was of medium smooth concrete. The side walls near the bottom were roughened by frost action and growth of moss, but higher up they were smoother. This accounts for the roughness values shown on Fig. 5, starting at approximately 0.013, increasing to a maximum about 0.0177 and then decreasing to about 0.0154, as the discharge increased.

It seems to be generally agreed that where the area of flow of the combined air and water is used in the computations the friction coefficients will be substantially the same at high velocities as at low velocities. However, the actual velocities of the water particles are greater than those computed on this basis by an amount equal to the per cent of entrained air. In computing the trajectories for the design of vertical curves, if the use of full theoretical velocity of total drop is impractical, the velocities used should be higher than those based upon the ordinary friction values. In designing the chutes of the Bureau of Reclamation it has been customary to use Kutter's N of 0.014 for computing the depth of flow of the water including the air and an N of 0.008 for computing the velocities used in determining the trajectories limiting vertical curves and the entering velocities of stilling pools.

It has been argued that water at greater than critical velocity should show a different friction loss than at subcritical velocity because under the former condition the velocity is uniform throughout the flowing stream. There seems to be no good basis, however, for believing that the velocity is the same throughout the stream when flowing at greater than critical velocity. It seems probable that this idea originated because equal velocity distribution is usually found with supercritical velocity, since channels are rare in which supercritical velocity continues for a long enough distance to cause the formation of the unequal velocity distribution that occurs in most channels with the ordinary velocity conditions. Measurement by pitot tube and float in the Uncompahgre ditch (Fig. 6) showed that as the water proceeded down the ditch the velocity distribution became more uneven, reaching a distribution closely resembling that observed in rough pipes.

The observations on this ditch gave an unusual opportunity to check the accuracy of computations, giving the location of the hydraulic jump by the method described by Julian Hinds in his paper on "The Hydraulic Jump and Critical Depth in the Design of Hydraulic Structures," *ENR*, Nov. 25, 1920, p. 1034.

The results for three discharges are given in Fig. 4. For discharges of 250 and 650 sec.-ft. the agreement was reasonably close but was not so good for 400 sec.-ft. The reason for this difference in accuracy is not apparent. The conditions in the chute were particularly unfavorable to accurate determination, however, since the location of the jump was controlled largely by the uncertain factor of friction. Under such conditions too much dependence should not be placed on computed positions. For conditions where there is a considerable change in channel section or elevation, the position of the jump can no doubt be computed with considerable accuracy.

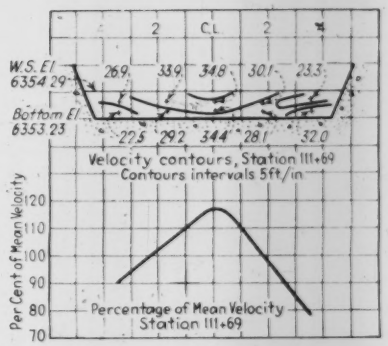


FIG. 6—DISTRIBUTION OF VELOCITIES in a shooting jet, as determined by measurements made in the Uncompahgre chute.

The experiments on this flume were made by G. C. Wright, assistant engineer, under the direction of the writer. The designing of all canal structures of the Bureau of Reclamation is under the direction of H. R. McBirney, senior engineer. All designing and research are under J. L. Savage, chief designing engineer, and R. F. Walter, chief engineer, Denver, and all activities of the bureau are under the direction of Elwood Mead, commissioner, Washington, D. C.

Cement Industry Employment Increased Under PWA

MORE THAN 70,000,000 man-hours of employment have been created since August, 1933, and over $130,000,000 of the amount paid for the producing and handling of cement used on public-works projects went as wages, according to a report issued by the Bureau of Labor Statistics. These figures are for indirect labor and do not include work developed in placing concrete on the construction site.

Ths study is the second of a series that the bureau is conducting in an effort to secure accurate measures of indirect employment. Reports made by contractors to the Department of Labor show that 62,000,000 barrels of cement were required for use in the first PWA program up to October, 1935.

Breaking down the figures further, the report shows that an average of 1.26 man-hours of labor is required for each barrel of portland cement produced. Transportation of the cement to the construction site accounts for the larger share of labor requirements, involving 0.503 man-hours per barrel, while the manufacturing process requires 0.399 man-hours for each barrel produced. The remaining 0.074 man-hours are credited to administration and selling. This is held to be only a partial picture of the increase in employment that was brought about by the demands for cement on PWA projects, because each barrel of cement produced involved 0.283 man-hours of employment producing and transporting raw materials.

Sewage-Treatment Trends in England

A critique of activities abroad in which are summarized changes of procedure and their relation to developments in the United States

By Karl Imhoff, Consulting Engineer, Essen, Germany

Translated by Gordon M. Fair
Professor of Sanitary Engineering, Harvard University, Cambridge, Mass.

ENGLAND was the first country in the world to study problems of sewage disposal and apply methods of treatment to purify the large volumes of waste emanating from the centers of concentrated population that developed after the Industrial Revolution. The water courses of the country are comparatively small, and it was not practical or possible to empty untreated sewage directly into these streams. As a result of this early and compelling necessity to make proper provision for waste disposal, we find that England has not only numerous and complete sewage-treatment plants but that the most important contributions in method of treatment have originated there.

Since about 1909, English sewage works have been overtaken by American plants in regard to odorless operation of settling and sludge tanks. American plants secure freedom from odor by keeping the sewage in sedimentation tanks fresh and by digestion and rapid drying of sludge. However, during the last two years a revolution may be observed to have taken place in England in this respect. This change is proceeding along paths somewhat apart from American development because of differing local conditions and long-established governmental regulations. For these reasons it may be of interest to present a survey of present English treatment methods and to compare it with American practice, for such comparisons generally contribute to further progress in the art. Two recently completed activated-sludge plants, those of Birmingham-Coleshill (1½-m.g.d.) and Mogden (48-m.g.d.), and next to them the Bradford works (22-m.g.d.), which incorporate chemical pretreatment and grease recovery in advance of trickling filters, have been chosen as representative installations for this purpose.

Screens and grit chambers

For many decades England has equipped its racks or bar screens with mechanical rakes. It is noteworthy that their use is being discontinued today in several plants, and that there is a tendency away from fine racks to coarse. At Bradford and Huddersfield the mechanical racks have been abandoned and removed, and only coarse bar screens of simplest form are used. These are raked but seldom, and then by hand. At Birmingham the screenings are collected on a rack provided with a mechanical raking device and then conveyed to a comminuter, which consists of a pump whose impeller is studded with knives. Screenings pass through the comminuter with a stream of sewage and thence to the settling tanks. These "wet" comminuters operate almost noiselessly and are preferred to dry shredders. Comminuters are also installed at Mogden.

In the older English plants the grit chambers were called "detritus tanks." They had a detention period of at least half an hour and hence were nothing more than settling basins that retained sludge as well as grit. In the new works at Mogden, Coleshill and Manchester, many-channeled grit chambers with adequate flow-through velocity have been built. The most complete installation is that at Mogden, where automatic switching and automatic adjustment of the flow line to the varying rates of flow are intended to maintain the velocity at all times exactly at a value of 1 ft. per sec.

● Modification of practice which reflects new trends in English sewage-treatment methods is the theme of this article by Dr. Imhoff, who discusses past and present procedure in outlining recent developments abroad. He observes that one of the most striking differences between English and American practice lies in the design of sedimentation tanks. In this country the governing principle has been odorless operation secured through short detention periods of two hours or less, and frequent removal of sludge. English works, on the other hand, universally use basins whose ample dimensioning provide detention periods giving eight to sixteen hours' capacity of dry-weather flow during which strong stenches develop from the putrifying settled sludge. To retain the advantages afforded by long detention periods and yet be free of associated odors, some of the new designs call for duplicate settling-tank installations in which sludge-removing mechanisms are used.

● Closely paralleling American practice is the trend toward controlled sludge digestion in heated and covered tanks followed by sludge drying on sand beds. The vogue is toward two-stage digestion in which only the primary tanks are heated and covered for gas collection, while the secondary units are unheated and open.

● Trickling filters are enjoying a wide and increasing popularity where secondary treatment measures are needed. Use of the activated-sludge process, originally hampered by patent litigation, is progressing more slowly than in the United States chiefly because of the operating difficulties encountered by some industrial cities in the treatment of their wastes. Of considerable interest is the fact that chemical precipitation, discontinued in most plants after 1914, has survived only as a preliminary treatment method to relieve the load on biological units in plants where industrial wastes predominate. —EDITOR.

Settling and stormwater tanks

The greatest differences between English and American practice lie in the design of settling and stormwater tanks. Since 1909 the governing American principle has been to keep treatment works free from odors, which result is attained:

1. By keeping the sewage in the settling tanks fresh. For this purpose the flow-through period is restricted to 1 to 3 hours, and sludge is removed continuously from the tanks.

2. By drying the sludge rapidly, either on sand beds (when the sludge has been rendered odorless by digestion) or on vacuum filters.

English practice stands in marked contrast. Settling tanks are given, on principle, a capacity of ten to fifteen hours of dry-weather flow and are supplemented by stormwater tanks with a capacity corresponding to at least six hours of dry-weather flow. The result is a tank capacity of 16 to 21 hours of dry-weather flow.

This dimensioning of tanks is in accordance with the regulations which the Royal Commission, founded in 1898 (called the Iddesleigh Commission after its chairman) laid down in its fifth report (September, 1908). These regulations require that the dry-weather tanks, and with them the biological portion of the plant, must take care of a threefold flow in times of storm. Under storm conditions the sedimentation units still give a detention period of three to five hours. The stormwater tanks are generally intended to stand empty and to be placed in service only when three times the dry-weather flow is exceeded. They then receive a sewage of between three- and six-fold dilution, which must be returned to the dry-weather plant after the rain has ceased. If the rain continues for a longer time, the stormwater is allowed to overflow into the stream after clarification. Only sewage that has been diluted more than six

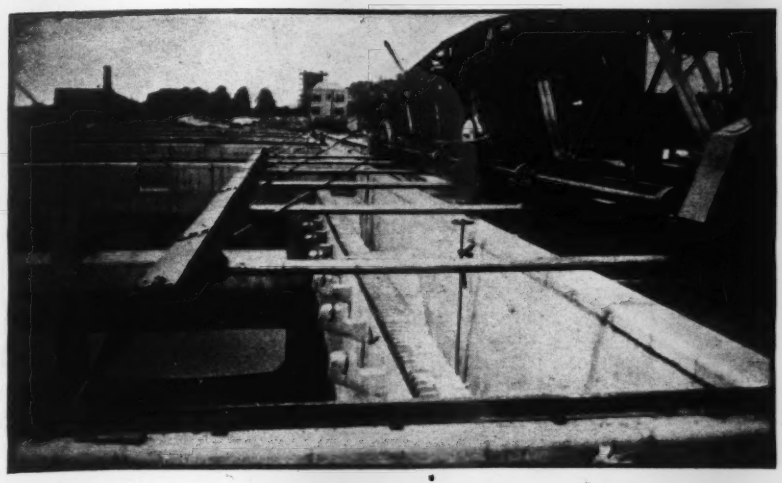


FIG. 1—AN ENTIRE BATTERY of rectangular settling tanks is mechanically cleaned by this sludge-scraper car at the Mogden purification works. Besides traveling the full length of each tank the mechanism may be shunted to operate on any of the neighboring units.

times may be discharged without treatment.

Operation of such extraordinarily large basins, which as a rule are cleaned only by hand, carries with it the natural consequence that the putrefiable sludge lies in the tanks for weeks and months. Strong stenches from sewage and sludge are quite unavoidable, and in almost all plants this malodorous sludge is pumped onto large land areas. Since all English plants originally employed broad irrigation, there is always enough room to permit this practice. Sludge disposal is easier for cities like London and Manchester that lie near the coast; these resort to dumping at sea.

Since 1912, Birmingham has been a creditable exception in its method of sludge treatment. Here J. D. Watson endeavored successfully to make the plant odor-free, to keep the sewage fresh, to digest the sludge separately, and to dry it on sand beds. In all plants of newest trend, particularly at Coleshill and Mogden, this Birmingham procedure has been adopted. Other advances originating elsewhere, such as mechanical sludge removal and heating of digestion tanks, are also being employed.

The large dimensioning of settling tanks, however, has persisted from earlier times. Even in the newest works the tanks are four to five times the size that they would be in America under the same conditions. This is not merely due to governmental regulations and habits of earlier times, but also because of the following technical reasons:

1. English treatment plants such as the Bradford and Huddersfield works, receive extremely heavy loads of industrial wastes and particularly of industrial sludge. Industrial sludge predominates to such an extent that not a trace of gas production can be observed in the settling tanks, which are filled almost to the water line with deposited solids. There is little reason therefore in removing the sludge frequently or even in treating it in digestion tanks. Long detention periods are favored because more solids are settled out of the sewage.

2. In plants treating sewage containing trade wastes, it is advantageous to provide tanks with long detention periods because this tends to equalize surges of wastes issuing from individual factories. With short detention periods, the discharge of toxic or acid wastes can poison a biological treatment plant. The larger the tanks the more it may be assumed that this danger is avoided, and besides a certain equalizing takes place between the polluted day flow and the clean night flow.

3. English industrial cities, furthermore, lie on unbelievably small streams, and the river water is used over and over by the industries. Under these difficult conditions the English have long realized that consideration must be given to the pollution discharged by stormwater overflows during rainy weather. They recognized that adequate dimensioning of all settling tanks was the best safeguard.

When one reflects upon these unusual conditions, it is appreciated that large settling basins possess many desirable advantages, particularly when they can be constructed at small cost. However, it would be favorable to progress in English sewage-treatment practice if in suitable cases dry-weather tanks with short detention periods were approved. Plants could then employ modern tanks with continuous mechanical sludge removal or two-story tanks. The use of these in the past has been curtailed chiefly because of the large capacity requirements. Ample dimensioning of stormwater tanks, however, is justified.

At the Mogden and Coleshill works, a skilful balance has been struck between modern sludge removal and long detention periods by dividing the settling tanks for preliminary treatment into two stages. Those of the first stage, in which most of the sludge is deposited, are circular and have continuous scrapers, while those of the second stage are rectangular and are served by a scraper car, handling several tanks in succession (Fig. 1). The round tanks are distinguished from the type of construction that predominates in America by possessing hopper bottoms with a slope of 30 deg. This facilitates the work of the revolving sludge scraper. At the apex of the hopper there is a collecting sump that will hold a day's deposit of sludge.

FIG. 2—TRAVELING DISTRIBUTORS, such as are pictured above, are favored for trickling filter beds in England where the climate is milder than in this country; rotary distributors are used in the smaller plants. Spray nozzles, so widely used in America, are seldom installed.

Sludge digestion in two stages

As has already been indicated, the English have not until recently laid any special emphasis on the treatment

and disposal of sludge. Although two-story tanks had been in operation in numerous large foreign plants since 1907 and single-story digestion tanks had been in use in Birmingham since 1912, it is wondered why the Iddesleigh Commission in its final summarizing report of February, 1915, could not recommend a satisfactory method of sludge treatment.

The Birmingham process of separate sludge digestion in earth basins was started in 1912 and still has great significance. An essential feature is that in the force main that leads to the digestion chamber, fresh sludge is mixed with old sludge undergoing alkaline-methane fermentation. The chambers are earth basins of simplest form that are arranged to operate in two stages. Seeding sludge is taken from the second stage. The ratio of seeding sludge to fresh sludge is 1 to 3.

In the newer plants at Birmingham-Yardley and Birmingham-Coleshill, two-stage heated rectangular digestion tanks have been constructed. The initial stage tanks are provided with floating gas covers made of steel plates, and the second stage digestion tanks are open. At Coleshill the cooling water of the gas engines is employed in a cycle so that it is first heated by the exhaust gases and is then used to heat the alkaline overflow from the digestion tanks of the second stage. The heated sludge liquor is introduced into the first-stage digestion tanks as heating water. A temperature of 70 deg. F. is maintained in the summer and 60 deg. F. in the winter season.

The Mogden plant, too, has two-stage digestion tanks. In contrast to Birmingham, however, all digestion tanks are circular in plan. The first-stage tanks are heated and covered, half of the tanks being provided with floating gas holders as covers and the other half with fixed roofs. The second-stage tanks, unheated and open, are situated at the sludge-drying beds. In addition to serving their function for secondary digestion, they are also used as storage tanks during the winter months when no sludge is drawn on the drying beds.

Heated covered digestion tanks, similar to those of the first stage at Mogden, are under construction in numerous old English plants for treatment of the sludge, which hitherto has been pumped in fresh condition onto the land for drying.

Digestion capacities are computed at 5 cu.ft. per capita for unheated plants and at 2 cu.ft. per capita for heated ones at Birmingham. At Mogden, 1.5 cu.ft. per capita are provided in the first stage and 2.5 in the second, a total of 4 cu.ft. per capita. It must be remembered, however, that the second stage is conceived chiefly as a collecting chamber, but that on the other hand all of the excess activated sludge is treated together with the fresh sludge.

FIG. 3—PRESSES for dewatering sludge are still being successfully operated at the Bradford sewage-treatment works, and the dried cake is finding a relatively good market as fertilizer. The presses are heated with steam to facilitate grease removal.

The circular open digestion tanks of the second stage, with diameters of 100 ft. and hopper bottoms, cost only $10 per 1,000-gal. capacity.

Sludge drying

The new English plants operating with good digestion tanks include sand beds after the proved pattern of the old Birmingham plant. Examples are the Mogden works and the Long Reach, Dartford, plant of the West Kent Main Sewerage Boards near London. The drying beds are cleaned by hand. At Mogden relatively large areas have been provided (1.3 sq.ft. per capita) because drying is to be restricted to the summer months.

At Bradford and Huddersfield the old English sludge presses are still successfully operated. The Bradford presses (Fig. 3) are heated with steam to facilitate grease separation. The press cake is sold as fertilizer. In general, a relatively good market for dried sludge still exists. At Dartford the limed digested domestic sludge is prepared as fertilizer.

Chemical treatment

Twenty to 30 years ago very many English plants were still working with chemical precipitants, among them the London works. After 1914 the use of chemicals was discontinued in most of these plants. Chemical precipitation has survived in some plants as a preliminary treatment method in advance of trickling filters, particularly where industrial wastes have interefered with biological treatment—for example, at Bradford, Huddersfield and Leeds.

In these cases chemical pretreatment is a complete success. At the Bradford works, mentioned previously as one of the three representative plants, precipitation is accomplished with sulphuric acid in the first-stage settling tanks and with available alkaline dye liquors in the second stage. Only with these precipitants and with the twelve-hour detention period, which at the same time serves to equalize the irregular tributary flows, is the sewage freed from wool grease and so far prepared that it can be discharged without harm onto the trickling filter. Here probably none of the "modern" settling methods would be of value. Tanks with short detention periods, continuous sludge removal and digestion of the sludge would have no value. The sludge will concentrate to a water content of 80 per cent if permitted to remain under a long-submerged storage. To provide for the removal of the tremendous quantity of settled sludge, grease recovery and fertilizer production constitute the only possible processes because all the sludge can thus be disposed of, and, in addition, the operating costs are covered by receipts.

Trickling filters favored

Trickling filters, widely prevalent in England, have during recent years been much improved in operation. Flies are seldom seen, and during their period of development in May they are combated by adding certain substances, such as acids, salts or creosote and soap, to the beds. The size of the filter material is about ¾ to 1¼ in., which is smaller than is used in America because of the stronger sewage dealt with. The filter depth is always 6 ft., and the loading about 750,000 gal. per acre per day; this low rate in comparison with American practice is necessitated by the strong sewage and by the order requiring the treatment of the threefold flow during storms.

Spray nozzles are considered poor distributing devices for trickling filters. To be sure, they have not been used in

conjunction with dosing tanks, as commonly employed in America, which secure more uniform distribution by varying the head on the nozzles. Rotary distributors are considered best for small plants and traveling distributors for large ones (Fig. 2). It is admitted, however, that traveling distributors are not adapted for use in snow and that for this reason they are probably not as widely employed in certain parts of America.

It is noteworthy that the Bradford beds are constructed of anthracite. The coal is weather-resistant, and the correct grain size can easily be obtained in any desired amount. The supply stored up in the filters has on occasion been sold at great profit during strikes and has then been replenished.

Trickling filters will retain their importance in England because they are less sensitive to industrial wastes and septic sewage than is the activated-sludge process. Contact filters have not been built in a long time.

Experience with activated sludge

Use of the activated-sludge process is progressing more slowly than in America. Patent questions originally hampered the advance in England, but today the chief hindrance is the difficulty encountered by some industrial cities in the use of the process. The Reading plant has not yet overcome the operating difficulties caused by industrial wastes, and the plants at Manchester and Bury have similar problems.

Of the different aeration processes, surface aeration using Haworth channels is most common in the older plants. This process was adapted to the special case of Sheffield, where the old contact beds were readily changed into aeration channels by the construction of thin dividing walls. In comparison with the compressed-air process, the Haworth system, because of scant air supply, requires very large areas and long aeration periods—sometimes as much as 24 hours.

The Simplex system, too, is much employed for surface aeration. Comparative tests have shown that long aeration periods are necessary. At Birmingham it has been found that re-aeration of sludge by the Simplex system requires sixteen hours, while with compressed air only eight hours are needed. Power consumption is no higher than for compressed air.

Where the compressed-air process is used, preference is being manifested for ridge and furrow construction. This has been adopted in the new plants at Mogden, Coleshill and Manchester.

In all English plants the excess sludge is pumped into the influent to the preliminary settling tanks. This practice is adopted not alone for thickening the sludge but because it has been found in some plants that the flocculent activated sludge improves the sedimentation efficiency of the preliminary tanks when the sludge is introduced uniformly over the entire day.

In some plants thickening tanks have also been constructed for the activated sludge. At Manchester the new Dorr "picket-fence thickener" is being operated. It is assumed that such thickening tanks are unnecessary when the activated sludge is pumped to the influent of the preliminary tanks.

Sludge re-aeration

Re-aeration of sludge is employed in a great many plants. Aeration periods vary from eight to sixteen hours. At Birmingham, re-aeration is absolutely essential, because this is a case of partial activated treatment (bio-flocculation) of the sewage in advance of trickling filters. Because of the shortened aeration period of the sewage, the activated sludge is purposely overloaded and hence must be re-aerated to render it capable of doing its work again. The preference for re-aeration is probably founded on the dangers that accompany treatment of industrial wastes. Occasional poisoning of the activated sludge must always be reckoned with, and re-aeration provides the opportunity for protecting at least part of the sludge against damage.

Almost all of the final settling tanks of the activated-sludge plants take the form of hopper-bottomed tanks with vertical flow. They are computed for detention periods of six hours of dry-weather flow, so that they retain a flow-through period of two hours with the threefold storm dilution. The slopes of these hoppers are made very steep, and since certain ground depth must not be exceeded a great many of these small units are required in large plants. There is at present a tendency to employ larger, flatter tanks equipped with sludge-removal mechanisms.

The activated-sludge process is considered unsuitable or inapplicable where strong sewage and predominantly industrial sewage are to be treated. In such cases a combination of activated-sludge treatment with trickling filters is provided, in accordance with the Birmingham plan. In this plan the trickling filters are placed in the second stage, because they are particularly well suited to treat dissolved substances and the finest colloidal matter.

Broad irrigation

At Birmingham-Barston a modern type of broad irrigation is provided. The effluent from the trickling-filter humus tanks is discharged over a grass plot without percolation of the sewage into the soil. The fine floc carried in the trickling-filter effluent is trapped by the blades of grass, and the run-off from the irrigated area is perfectly clear and free from all suspended matter. The area required for this process is 1 acre for 10,000 people.

At Bradford an impounding reservoir was provided about two years ago for the post-treatment of the trickling-filter effluent. The area is 13.5 acres and the capacity 19 m.g., corresponding to twenty hours of dry-weather flow. The reservoir retains the fine sludge matters well, and since it is operated only in summer it can be drained in the winter for cleaning. As an experiment a portion of the reservoir water is being returned to some of the trickling filters for dilution purposes.

Summary

Although England is already provided with numerous and very complete sewage-treatment works, marked construction activity is manifest. Biological treatment is being planned in many places to supplement plain sedimentation. In densely populated districts there is a rising tendency to centralize sewage treatment in large works, and the existing small works are being abandoned. In the larger older plants, tank operation is being improved by equipping the tanks with sludge-removal mechanisms and by making provision for sludge treatment in heated tanks.

Technically, sludge treatment is approaching American practice more closely. Fundamentally different, however, remains the ample dimensioning of English settling tanks. In the case of dry-weather tanks, the long detention period of eight to fifteen hours, based on antiquated regulations, is a hindrance to the more extended use of modern forms of settling tanks. Long detention periods, however, possess many advantages, particularly in cases where there is heavy industrial pollution of the sewage. Use could sometimes be made of this consideration in other countries.

Trickling filters have been much improved during the last few years. Fly nuisance has been almost entirely eliminated. Rotary and traveling sprinklers are considered the best distributing agencies.

The activated-sludge process is making further progress. Digestion of excess sludge and utilization of sludge gases as a source of power has also been established in England. Where there is considerable industrial pollution, a combination of biological methods is considered necessary. In this connection the activated-sludge process, with short aeration period and re-aeration of the sludge, serves as the first stage of treatment and is followed by trickling filters.

Chemical sewage treatment is employed with good success in some plants receiving industrial wastes. It serves as a stage treatment in advance of trickling filters. For the drying of the chemically treated sludge, filter presses continue to give satisfaction.

Underpinning Camden Approach of Delaware River Bridge

Viaduct columns and retaining walls intercepted by new subway construction underneath are given new footings and transferred to subway roof

By Edwin R. Albertson
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THE CONSTRUCTION of a rapid-transit railway now in progress across the Philadelphia-Camden bridge and into subway at both ends required a cautious underpinning operation at the Camden end. In designing the bridge, which was completed in 1926, provision had been made for carrying the future rail lines on brackets on each side of the roadway. At the ends of the bridge the rails leave the surface and go underground. In Philadelphia the east and westbound subway tracks leaving the bridge remain separated until they reach Race St., where the new subway connects with the existing Ridge Ave.-Eighth St. subway. However, at the Camden side it was expedient to bring the two tracks together under the bridge approach before turning south from under the bridge. United at about ground level, the tracks continue in subway for several hundred feet under the bridge approach. No provision had been made for this latter condition when building the bridge, and it became necessary to underpin the substructure of the approach, removing much of the original foundation, and transferring the bridge load to the new subway as it was constructed.

At the Camden end the rails leave the general bridge level by ramps, turn in under the bridge and continue their descent into subway. A plan of the structure to be underpinned, and of the subway to be built under it, is shown by Fig. 2. Here the transverse bents of the approach are reinforced-concrete girders and columns, carried on continuous longitudinal footings; this type of construction ends with a wall at bent 29, west of which the bridge is carried on structural-steel bents.

The general elevation of the ground surface here is at about +12, referred to a datum 2.25 ft. above mean high water in the Delaware River at Philadelphia. Groundwater was usually found at about El. +1; hence in all deep excavations water had to be handled. The soil consists of layers of sand, clay, gravel and river mud, varying in different locations in thickness and depth. Below elevation all strata of sand or gravel were waterbearing.

FIG. 1—SHORTENED COLUMNS of approach viaduct supported on twin roof girders and wall columns of subway, which is being constructed underneath.

Picking up bridge columns

Work got under way with the underpinning of the footings of the columns and south wall of the bridge, adjacent to the subway cut; the underpinned portions of the structure are indicated in Fig. 2 by shaded areas. The depths to which the new foundations were carried varied according to the distance from the subway and the elevation of the adjoining subway wall footings. This was determined by slope lines (Fig. 2).

The customary methods were used for underpinning these footings. Pits were carried down with horizontal wood sheeting as far as possible below the water line. At this level an inner row of vertical wood sheeting was driven; the pit being carried down with breast-boards at least far enough to permit the vertical sheets to be set up in place. At times there were six or eight pits being sunk simultaneously; pumping from the deeper pits had very little effect on the water level in the newer holes, largely due to the layers of impervious material separating layers of sand and gravel.

As each pit reached grade, it was concreted up to a point above water level; forms were then set up in the upper portion of the pit and concreted to a point about 4 in. below the bottom of the old footing. Thereafter the space between the old and the new footings was filled with dry-packing.

The underpinning of the column footings was started near the end wall at bent 29 and progressed eastward. When this preliminary work had progressed sufficiently, the actual construction of the subway commenced with the sinking of pits for the footings of the subway columns at bent 30. Fig. 3 illustrates the progressive steps in the process of shoring the bridge bents, sinking the pits, setting the steel columns and girders and transferring the bridge load to the new steel bents of the subway.

At 3-A the concrete bridge bent is shown supported on its continuous longitudinal footings; as shown at 3-B, the next move was to pick up the bridge load with shoring on screw jacks set on timber cribbing. By taking up on the jacks daily, or as often as necessary, the bridge was maintained in position, in spite of any subsidence in the ground caused by the vibration of heavy traffic overhead.

In order not to reverse the stresses in the concrete girder, the shores were placed as near as possible to the columns. In so doing, one set of posts was located directly over each pit, and heavy steel girders were set on sills on the ground so as to span across the pits. A timber cross-piece was placed on the girders and the shores erected; the jacks were then turned up all across the bent, relieving the load on the column footings, after which the old footings and the lower ends of the columns were cut away.

Pits for the column footings were then laid out and started, square-edge vertical sheeting 3 in. thick being set up and driven with air-hammers a short distance ahead of the excavation. Gaps had to be left in the vertical sheeting where the girders interfered, horizontal lagging being set in behind the vertical sheeting as the excavation progressed. At bent 30 the pits were comparatively

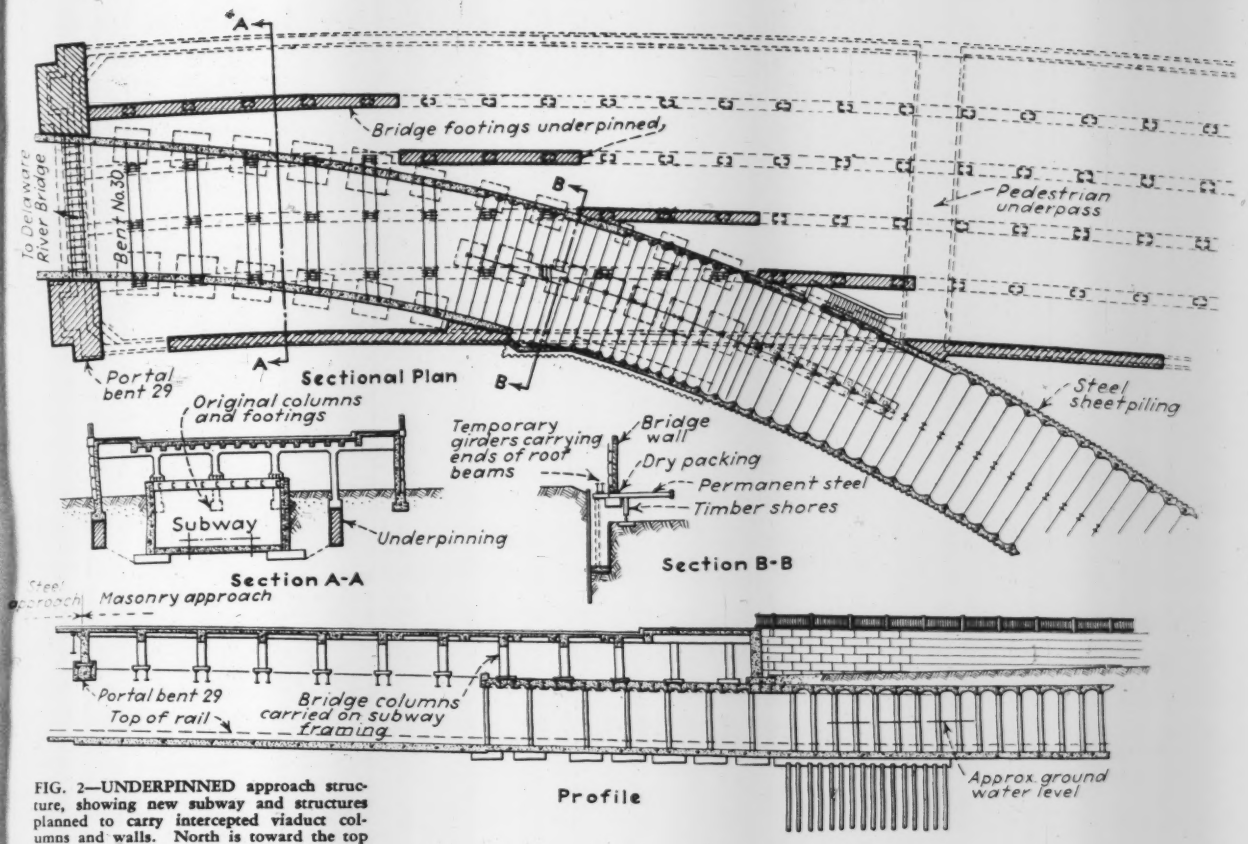

FIG. 2—UNDERPINNED approach structure, showing new subway and structures planned to carry intercepted viaduct columns and walls. North is toward the top of the plan.

shallow, getting deeper toward the east. Although water was encountered in all the pits, one small centrifugal pump at each was generally able to keep the water under control. A fine running sand, scarcely "quick," was found at the bottom of the deeper pits, requiring a backfill of coarse gravel to keep it from boiling.

With the pit sunk to grade, the concrete footing was poured, and the water allowed to rise to its natural level, remaining there until after the concrete had set. In this way scouring and washing away of the grout by a continuous flow of water was prevented. The water was then pumped down to set the steelwork which was to support the subway walls and carry the bridge. Each new bent consisted of a pair of steel girders, set one each side of the concrete column bent. Each girder was supported by two steel columns, located so that the inner face of the column lined up with the inner face of the subway wall. Each pair of girders was securely tied together with channel struts.

The weight of the bridge was then transferred to its new support. One by one the original shores were replaced by shorter ones, resting on the new steel girders, as shown at Fig. 3-C. With the weight of the superstructure now being carried on the new steel, the girders were deflected to their final position, and the column footings were thus pre-tested to their full load. The concrete columns were then cut off to a point above the top of the girders, and three short I-beams were set in place across the girders under each column. The small I-beams were welded to the top flanges of the steel girders and concreted in place. Dry-packing was then tightly rammed in place between the I-beams and the bottoms of the concrete columns, preventing any settlement after the shores were removed.

Operations were carried on simultaneously on two or more bents, at the same time carrying forward the work of underpinning the old wall and column footings. The heavy steel needles for carrying the shores were snaked about under the bridge with steel cables, snatch-blocks and a one-drum air-hoist, as were also many of the structural members for the new framework. Work was done in very crowded quarters, passage being obstructed by open pits, a forest of timber shoring, cribbing, needles and new steelwork. The concrete for the footings was transported largely in wheelbarrows from the transit-mix trucks that could not get beyond the portal at bent 29. Much of the material was brought in by hand, through an opening cut in the portal wall, before the wall itself was ready to be picked up and carried on beams, as shown in Fig. 2.

The most exacting portion of the work was encountered in supporting the south wall of the bridge across the wide subway cut until the new framework was in place to carry it. Starting at the west side of the subway, excavation was carried down 4 or 5 ft. below the wall footing, and shoring posts supported on timber sills were introduced. The excavation continued eastward across the cut as the shores were set, until all of this portion was clear of the ground. The ground on both sides of the wall was then excavated to the level of the sills of the supporting posts, the sheeting for the subway at this point having been driven some time previously.

At the west side of the cut the procedure was then as follows: Holes were cut at intervals in the wall, permitting the steel roof beams of the subway to be set in place, acting temporarily as needle beams. The inner ends of the beams were carried on the permanent steelwork, all of the frame having been erected inside the bridge wall as far as possible before starting this part of the work. At the outer end the roof beams were hung from temporary steel girders, set parallel to and immediately adjacent to the wall (Fig. 2). The west end of the temporary girders rested on undisturbed ground outside the steel sheeting, while the east end was supported on timber cribbing, screw jacks being used at both ends to take up the settlement.

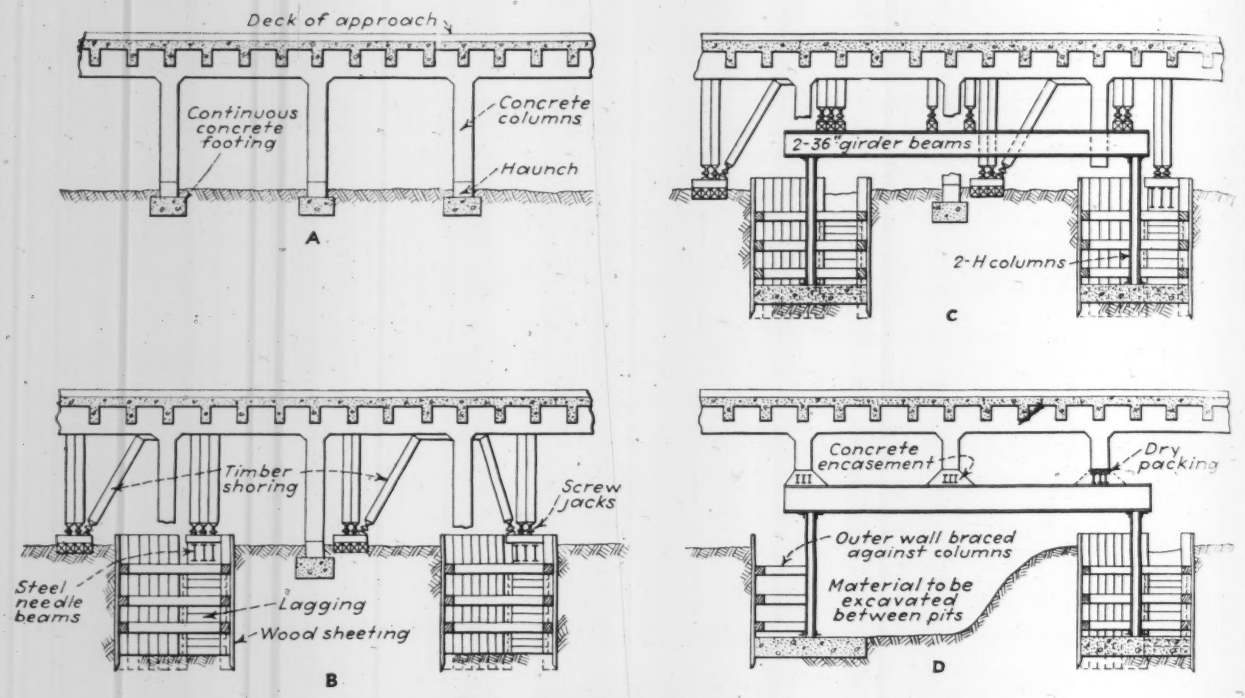

FIG. 3—SUCCESSION of operations in transferring support of approach viaduct columns to roof of new subway structure.

The roof beams were further supported on shores inside the line of the bridge wall. The wall was brought to a bearing on the roof beams by means of dry-packing, after which the original timber posts under the wall footing were removed. A long narrow pit was then sunk to subgrade of the subway at this corner, a combined column footing poured and the steel wall columns erected. With the roof beams now supported on the permanent steel columns at both ends, the timber shores and temporary girders were removed at this point, and the bottom of the bridge wall was cut away to the level of the top flange of the roof beams.

The procedure was somewhat more simple over the center section of the subway cut. Steel needles were placed under the bridge-wall footing, resting on cribbing at the inner and outer ends. Dry-packing was again used to provide a full even bearing on the needles. Pits were then excavated, one for the center column almost directly under the bridge wall, and a long narrow pit for the west wall columns of the subway. The steel needles were placed low enough so that they did not interfere with the placing of the roof beams. Pouring the concrete side walls of the subway followed closely behind the erection of the steelwork, thereby stiffening the framework and keeping the bridge secure.

At the east side of the cut, work was held up until a group of pipe piles could be driven. Here also steel needles carried the bridge wall while the pits were sunk and the steel framework of the subway was erected. Thereafter, the bridge load was transferred to the permanent steel structure, and the north wall of the subway poured to the point where the sheeting began. Excavation of the material between the walls was then carried forward, followed by concreting the invert and roof.

The work was a part of construction contract No. 2, performed by the Marcus Contracting Co., Inc. The planning and execution of the work for the contractor was under the direction of Frank DeGaray. The design, field layout and inspection were performed by the engineering department of the Delaware River Joint Commission, with Modjeski, Masters & Case as consulting engineers. The project was made possible by a 30 per cent grant from the PWA. The government also maintained a corps of engineers on the job, to supervise the construction as well as the observance of the regulations which were laid down by the PWA for carrying out the work.

Ice Pressure on Russian Dam Relieved by Compressed Air

A MULTIPLE-ARCH DAM, about 3,300 ft. long, located near Magnitogorsk in the Ural Mountains in U.S.S.R., may be subjected to the thrust of a sheet of ice about 5 ft. 6 in. thick, producing a pressure on the face of the dam of 4,600 lb. per sq.ft. To relieve the dam of this critical stress, it was customary to cut the ice abutting on the crest of the dam by manual labor, an operation which sometimes required hundreds of men. In the winter of 1933-'34, according to N. L. Jungkind, writing in *Izvestiya Nauchno-Issledovatelskovo,* Instituta Hydrotechniki, Vol. 15, 1935, a compressed-air system was installed to prevent the formation of ice at the crest of the dam, similar to that used on some dams in this country. The installation consisted of a 1½-in. perforated pipe line laid at a depth of about 10 ft. near the upstream face of the dam and along its entire length. The perforations, 1 mm. (0.04 in.) in diameter, were spaced about 10 ft. apart. Compressed air was supplied at the rate of about 13,000 cu. ft. per minute by 60-hp. compressor plants at each end of the pipe line. Operating this installation for a period of 4 to 8 hours in 24 hours made possible the maintenance of a strip of open water, free of ice, along the crest of the dam even at temperatures of 22 deg. below zero (Fahrenheit). Between operating periods, a sheet of ice 2 to 4 in. thick might form at the dam crest. This would be entirely removed by running the compressed-air plant for half an hour or so. The ice-melting effect of compressed air is ascribed not so much to its direct mechanical action as to the stirring and mixing which it produces, thus bringing to the surface comparatively warm water with a temperature of 34 to 39 deg. F. from the lower levels of the reservoir.

Illinois Bridge Department Organized for Increased Design Demands

By W. N. Schroeder
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THE state highway organization in Illinois, as elsewhere in the United States, has been compelled during the last two years to handle a greatly increased volume of work in connection with the various federal projects that are under way. In addition, changes in allowable unit stresses and the general adoption of the rigid frame and the continuous type of structure made it necessary to discard a complete set of standard designs based on simple types and old unit stresses. No time was available to design and draw new standards. It was necessary to make a special design for each structure. Standards and design data had to be accumulated as the work progressed.

To handle this work, the bridge engineering force of the Illinois division of highways was increased from about 20 to 65 men. This took a number of engineers off the unemployment list. A number of these engineers came from the Chicago area, which is the state's largest engineering center during normal times. A proportionate number came from various other locations. Due to the unemployment situation, it was possible to obtain high-class engineers with experience along the required lines. Our records show that this increase in force has not raised the cost of engineering figured from the estimated cost of the completed work.

We have already completed a number of grade-separation projects and are now working on the expanded grade-separation program, which includes about 80 grade-separations involving 35 different railroad companies. About one-half of these structures are subways designed by the railroad companies. The overhead structures are designed by the highway department. One engineer was put in charge of all grade-separation work, with the title of "engineer of grade-separations." He has full authority to negotiate with the railroad companies, and he supervises the design of these structures.

In order to get uniformity and economy in the design of subway structure plans submitted by the various railroad companies, a group of three experienced railroad engineers was detailed to the work of checking and correlating the subway designs. Typical substructure designs were made as a guide, and a considerable saving has been effected by this checking procedure.

For bridge work in general, two engineers were detailed to formulate design policies, check up all bridge survey data, and recommend the most economical or satisfactory type of structure for each particular location. One engineer was detailed to spend all his time on specifications and cooperate with the design engineers on load distribution, stresses and other questions relating to specification practice.

One architectural engineer is employed, full time, on architectural studies and preliminary layouts of bridges for locations where architectural beauty is desirable.

For electrical and mechanical work in connection with bridge-lighting systems, pumping plants for subways and machinery installations, the part-time services of an electrical and a mechanical engineer are utilized.

With the organization, as outlined, the bureau of bridges has been able to turn out efficiently and satisfactorily enough bridge plans to permit holding a letting of contracts each week.

Some of the more modern types of bridges that have been designed during this period are as follows:

1. Fifteen single-span concrete rigid-frame bridges with solid deck, spans ranging from 30 to 50 ft. Several of these are skewed, the limit of the skew for this type being 30 deg.

2. Four two-span concrete rigid-frame bridges with solid deck spans, ranging from 20 to 30 ft.

3. Three single-span concrete rigid-frame bridges with girder deck. This type is used for skews of more than 30 deg.

4. Twelve reinforced-concrete continuous-girder bridges in three- or four-span units, ranging from units of 33-47-33 ft. to 83-113-83 ft., and from 47-54-54-47 ft. to 54-72-72-54 ft.

5. Twenty-five continuous I-beam bridges with spans ranging from units of 40-53-40 ft. to 72-93-72 ft., and from 42-55-55-42 ft. to 58-72-72-58 ft. A number of these bridges have creosoted-pile substructures.

6. Several continuous concrete-slab bridges.

There is now under construction a steel-truss bridge over the Illinois River at Meredosia. This bridge is composed of one simple truss span of 241 ft. at each end, and a continuous-truss unit of 496-567-496 ft. at the center.

Bids have been taken for a steel-truss bridge over the Illinois River at Havana. This bridge is composed of one 240-ft. simple-truss span, a continuous-truss unit of 360-420-360 ft., and a continuous I-beam approach of 75-94-94-75 ft.

Plans are being prepared for a steel-truss bridge over the Illinois River at Hennepin, composed of three continuous steel-truss units of 300-300 ft., 324-378-324 ft., and 300-300 ft., and an I-beam approach of 54-70-54 ft.

Contracts have been awarded for eleven bridges for a scenic road along the Mississippi River from Hamilton to Nauvoo in Hancock County. These bridges were designed with special attention to architectural appearance. It was found that the continuous concrete-girder type was both economical and graceful.

Several Cook County grade-separation projects have also been given special study from an architectural standpoint. One of these is where state route 68 goes under Rockland Road and the C.N.S.&M. Railroad. The rigid-frame type of construction was used for this location. Considerable study was made to harmonize the designs of the highway and railroad structures.

Present concrete culverts are of the simple-slab type, but design data are being prepared for culverts of the closed-frame type. Preliminary studies indicate that this type will effect a considerable saving.

This bridge organization and program is under the supervision of Ernst Lieberman, chief highway engineer. G. F. Burch is bridge engineer.

Erosion and Rock Scour at Molare Dam

DEEP EROSION of foundation rock by the outrush of stored water formed one of the characteristic and sensational elements of the failure of the Little Zerbino Dam, above Molare, Italy, reviewed by E. Probst in our issue of Oct. 31, 1935, p. 607. The author there referred to the prior observation of severe invert erosion in a diversion tunnel while the dam was being built. N. Kelen, of Moscow, U.S.S.R., whose report of this tunnel erosion in his book "Bestimmung des Tangentialen Sohlenwiderstandes von Gewichtsstaumauern," Berlin, 1933, was cited by Dr. Probst, now advises that the diversion tunnel in question was not located at the Molare reservoir but at the Mollaro Dam, a structure in another drainage area.

The Mollaro Dam referred to is located on the Noce River, a tributary of the Adige, and lies in the region between Trento and Bolzano; it forms part of the Mollaro-Mezzocorona power plant of the Società Generale Elettrica Tridenta, and was put in service in 1929.

The Zerbino Dam, lying near the village of Molare, is some 50 km. north of Genoa.

Using Aerial Photographs for Topographic Mapping

Available aerial survey used as base map for plotting contours and aiding in planetable work on a relief project undertaken to provide a complete topographical map of a Connecticut town

By H. E. Banks
Project Supervisor, Fairfield, Conn.

IN ANSWER to a need for data that would be available for town planning, sewerage and drainage studies, and in order to carry out some useful relief projects, the town of Fairfield, Conn., undertook a topographical mapping program of the entire 31 square miles within its boundaries. The work was so laid out that it was possible to make use of an aerial survey, completed in 1931, as a base map.

There were available two aerial surveys of the town by Fairchild Aerial Surveys, one made in April, 1931, and one in April, 1934. The scale of the earlier 8x10-in. contact prints was 1 in. to 700 ft., and of the latter 1 in. to 1,200 ft. As a scale of 1 in. to 200 ft. had been decided upon as best suited to the requirements of the town, it was decided to use the 1931 survey, as it needed an enlargement of only 3½ diameters against 6 diameters for the later flight. A minimum amount of detail was lost by using the smaller enlargement, and its full size fitted on a standard sized planetable without trimming.

An aerial photograph is in itself a complete map lacking only two characteristics, scale and relief. When these are added to the aerial picture, it becomes a complete and accurate topographical map. The project therefore involved obtaining these added data, transferring them to the aerial photograph and using this to make a complete topographical map that would supplement the aerial photograph.

The displacement of images on an aerial photograph, not considering tilt or lens distortion at the outer edges of the photograph, follows definite mathematical laws, all points being displaced radially away from or toward the center of the photograph as a function of the difference in elevation of the point from the center times the distance from the center. Points higher than the center are displaced radially away from it; points lower than the center, radially toward it. A nomographic chart showing the displacement from the center for all points within 2,500 ft. of the center horizontally, and 200 ft. from the center vertically, was prepared so that when a condition arose where no traverse control was available near the boundaries of a picture, the exact displacement could be figured and the point plotted in its true position. This, in effect, provided a control point that could be used on an overlapping picture as well. In relatively flat areas, these corrections were negligible on a map of 200-ft. scale.

Contour interval chosen

The contour interval chosen as best suited to the horizontal scale and intended uses of the map was 4 ft. The town extends 6 miles north, from Long Island Sound, to a maximum elevation of 400 ft. above sea level. The terrain is very rugged and contains thickly settled portions, salt marsh, rolling farmland and heavily wooded areas. An advantage of a 4-ft. contour over a 5-ft. contour is that if 2-ft. contours are desired in the future, it is a simple matter to take the photograph into the field and add the information necessary without duplicating any of the previous work.

In order to give the photographic laboratories measurements which would guarantee ratio enlargements within 1 per cent of accuracy, and to provide adequate control points to remove this possible 1 per cent of error and the displacements in the photograph due to relief, a system of horizontal control was laid down which would do both jobs. This control consisted of closed traverses running through the streets, incorporating wherever possible into the traverse network such existing data as railroad center-line layouts, state highway random traverses, and center-line pins of town street layouts.

Accuracy of traverse work

A total of 120 miles of traversing, divided into about 75 closed interlocking traverses, was either measured or taken from existing data. Any traverse showing a closure of less than 1 in 10,000 was either remeasured or eliminated, so that at the completion of this part of the work there were 850 points with coordinates computed to that precision. The U. S. Coast & Geodetic Survey completed a secondary traverse through the center of the town shortly after this work was done. By tying this work in with what was already completed a valuable check was obtained.

The points set by the town were ¾-in. diameter reinforcing rods 24 in. long, driven beneath the ground surface to preserve them for future use. References were taped to at least three and, where possible, to five landmarks. Temporary guard stakes were driven to facilitate finding pins for the duration of the work.

The traversing parties consisted of three men: a chief of party, an instrumentman and a chainman, with the chief of party acting as head chainman. Angles were read at least twice, and in traverses having over 20 sides the angles tripled or quadrupled and the mean reading was used. Chaining was done with an ordinary ¼-in. 100 ft. steel tape which was occasionally checked with a standard measurement. A thermometer fastened to the standard of the transit was read and recorded against each distance measured between pins, and the distance corrected to 62 deg. F. The chainmen were taught to approximate a 12-lb. pull when chaining, but no spring balances were used in the field.

Care was taken in the selection of traverse points so that suitable permanent references could be found. All pins were numbered consecutively as driven, each party being assigned a block of numbers. Great care had to be used in balancing angles to prevent trouble in closing the adjoining traverses. It was found best to delay computation of traverses until eight or ten could be set up at once, a rough sketch made on a large sheet of tracing paper, and the angles for all of the traverses balanced at once. Very little difficulty in obtaining a closure for all traverses of better than 1 in 10,000 was then experienced. The traverses were plotted by coordinates to scale on brown detail paper. Bearings, distances and coordinates were recorded on these sheets as a permanent record of the horizontal control.

Establishing benchmarks

The level work consisted of following up the traverse parties and establishing benchmarks every ⅛ of a mile along the traverse and obtaining the grade of the top of the traverse point. This netted 400 permanent benchmarks plus the 850 traverse-point elevations, which gave 1,250 points of known elevation distributed evenly throughout the area for the use of the plane-table parties later. Coast & Geodetic Survey benchmarks in the town checked the leveling work.

When the horizontal control had been established, contact prints of the aerial photographs were obtained, and two points on every third picture were picked for photographic control points. These points were chosen close to the horizontal control, so that they spanned a distance of from 1,000 to 3,000 ft. across the center of the photograph, care being taken that the difference in elevation of the two points did not exceed 50 ft. An angle and a distance were then taken to these points in the field, and the position of the photographic control points were carefully

pricked through the contact print. The coordinates of these points were computed, and the distance between them was noted on the back of the picture for the use of the laboratory making the enlargements. To check these computations, the points were plotted by angle and distance on the traverse drawings, and the distance between the plotted points was scaled. It proved perfectly feasible in quite a few instances to make the same control point serve for more than one picture due to the 50 per cent overlap. A total of 118 points was sufficient to control the whole area of 20,000 acres.

Contours plotted on photographs

The field method of obtaining contours was to place the ratio enlargements on a planetable and plot the contours directly on the picture, the blade of the alidade working directly on the surface of the picture. All problems of location of the occupied point are automatically solved by the picture itself. If the occupied point cannot be immediately found without measurement, a few simple stadia shots to house corners, walk intersections, trees, fences or any other physical feature visible on the picture quickly give the desired point. Once knowing the location of the occupied point, a few careful shots to points 1,000 ft. or so away quickly orient and check the orientation of the table, so that after the table is set up the problems of planetable traverse control, graphical triangulation and two-point and three-point layouts are automatically taken care of by the picture itself.

The smoothest-working planetable outfit consisted of a chief of party, instrumentman and rodman, the chief of party acting as a second rodman. Good results may also be obtained by having the chief of party act as instrumentman and using two rodmen.

The procedure used was to rod out each contour, using level shots and straight stadia readings. Benchmarks were carried along by the planetable and by working through the area in such a way as to return to the starting point, or by another benchmark previously set and reading turning points to one-hundredth of a foot, the closure after nine or ten set-ups rarely exceeded 0.2 ft.

Contours were plotted directly on the picture by grooving it with a 6H pencil. These grooves were later filled with red ink to make them stand out. Errors in location due to distortion of the scale from relief or to inaccurate enlargements are self-minimizing inasmuch as stadia shots over 600 ft. were very rarely made. And at distances of less than 600 ft. an error of 1 per cent is less than the width of the pencil groove. For the same reason the alidade stadia correction was omitted.

On stormy days when the field parties could not work, the men posted pin references and pin data from notebooks and computation books onto small 3x5-in cards, which were kept in a permanent file. Each pin had a card on the face of which was posted the number, elevation, coordinates, description of location and cross-references to the pages of computation books, level notebooks and traverse notebooks. On the back of the cards the pin references were sketched. Similar cards were made out for the benchmarks.

The office procedure for contouring consisted of the preparation of limit sheets, which defined the area to be contoured on each photograph. These limits were traced onto a vellum overlay which covered that part of the photograph not in use, protecting the finish from the elements, dirt and the blade of the alidade. When the photograph was completely contoured in the field, the information upon it was then transferred to the final tracings.

A study of the outermost coordinates showed that all of the town could be shown to 200-ft. scale on 29 drawings, 26x39 in., one drawing abutting another with no overlap. Each 2,000-ft. coordinate was ruled in ink on the drawing, and in addition the limiting coordinate of each sheet or match line was ruled. The traverse points were then transferred from the brown detail drawings to the tracings and pricked through with a needle. The same traverse points were then pricked on the photograph. At first these points were pricked in the field at the same time that the contouring was done, but it was found they could be pricked more rapidly and accurately in the office from the pin reference cards.

The tracing work was done on a plate-glass drafting table, 33x42 in., illuminated with a 100-watt lamp in a reflector and fixture which could be moved about with the foot to give maximum illumination under the particular place the draftsman was working. The cloth tracing was laid over the photograph and shifted until a point of light appeared through both the needle prick on the photograph and on the tracing. If the next traverse point was not coincident, it measured the displacement or scale error of the photograph and definitely instructed the draftsman how to shift out the error.

Street lines constituted the first information traced off in pencil, as in a majority of the cases these were adjacent to traverse lines. After these were inked, the contours were traced in pencil, using both the traverse points and street lines as guides in eliminating displacement and scale errors. If contour ends on adjacent pictures did not exactly match, it was instantly detected at this point, giving the supervisor a splendid office check on the quality of the field work. After the contours were inked, the streams and swamp areas were delineated. The centers of each photograph, traverse points and benchmarks were then traced and inked.

Cost and personnel

Accurate cost data have been kept for all phases of the work. A very wide spread in the cost of contouring was found for different areas and different conditions. Foliage, relief, built-up areas, weather and experience of the men all affect the cost sharply. The men were paid on a salary basis, but the average cost for winter and summer was the same, the bad weather in winter just offsetting the foliage in summer. The over-all average cost of the finished map is approximately $1.60 per acre. The larger per cent of this cost is borne by federal funds, the town's share being the cost of photographs, instrument rentals and supplies.

A careful survey showed that enough men were available who could be trained to do the work, some of them with previous surveying experience. As the work was largely repetitious, it was found by carefully exploring each applicant's capabilities and trying him out at various jobs that nearly every man selected could be relied upon to do some job accurately and completely.

The personnel averaged thirteen men, although 40 different persons were employed at various times. Prior to the inception of CWA, the work was started as a town emergency relief project, and it continued as CWA and later as an FERA project. The project was sponsored by John Ferguson, selectman, and A. H. Terry, consulting engineer, who conceived the idea of using aerial photographs and relief labor for the mapping of the town. Development of methods used and supervision of the work were done by the author, acting as project supervisor.

Air Hygiene Foundation To Conduct Research

Air Hygiene Foundation of America, Inc., has been formed by a group representing various industries, with headquarters in Pittsburgh, Pa., to conduct investigations and research on problems in the field of air hygiene. A comprehensive investigation has been begun at Mellon Institute of Industrial Research, Pittsburgh, under the support of the foundation. The hygienic, technologic, and economic aspects of air contamination, especially by dust in the industries, wil be studied.

H. B. Meller, who has been appointed managing director of the foundation, will head this investigation at Mellon Institute. During the past fifteen years he has been in charge of the program for the abatement of smoke and dust in the city of Pittsburgh; and since 1923 he has headed the air-pollution investigation at Mellon Institute.

Rigid-Frame Design by Elementary Mechanics

Simplicity of procedure exemplified by design of a single-span railroad bridge with pinned ends

By C. D. Williams
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SEVERAL METHODS of solution for single-span rigid frames have been published which have made the problem seem complicated or have made arbitrary assumptions that invalidate the results. In the common problem of the single-span frame with pinned ends, for example, there is only one unknown force for each condition of loading, the force which prevents change in span length, usually called H. As soon as the value of H is found, the stresses are determinate.

The horizontal change in span length due to moment may be expressed as $\sum \frac{M}{EI} yds$ in which ds is a length along the neutral axis, M is the bending moment at the ds length, y is the vertical distance from a line connecting the pins to the center of the ds length, and I is the moment of inertia at the ds length. The length ds may be taken as a finite distance when the values for M, I and y in the rigid frame under consideration are average for the length taken.

The bending moment M may be considered as composed of two parts, M' and Hy, in which M' is the bending moment that would exist in the frame with ends unrestrained against span change or the simple beam moment, and Hy is the product of the restraining force and its lever arm.

In addition to the span change due to moment, there is a shortening or lengthening of the neutral axis in the direction of the span length due to direct force. This value is neglected in most of the methods in general use and is in fact of small importance in most ordinary structures. The effect of this change in span length will be considered separately.

Omitting the change in span length due to direct stress, the one equation necessary to obtain the value of the unknown H will be $\sum \frac{M}{EI} yds = 0$, or $\sum \frac{M'}{EI} yds + \sum \frac{(Hy)}{EI} yds = 0$. All values are finite and determinate except H, which may be obtained as soon as the equation is evaluated.

Fig. 1 shows a single-span rigid frame on pins which it is proposed to design to carry a ballasted floor with E70 railroad loading; five such frames per track, to be constructed of silicon steel, are to be provided.

Table 1 shows the complete calculation of dead-load moments in the frame, including the moment correction due to rib shortening. The gravity axis of the structure is divided into a convenient number of finite ds lengths, in this case twenty. The x and y distances at the center of each ds length are scaled and entered in Table 1. The x distances are used only for convenience in computing the simple moments. The moment of inertia at the center of each section in ft.⁴ is computed and entered. The simple-span dead-load moments are then entered in the column marked M'. The values $\frac{M'}{I} yds$ may be computed and the values $\frac{(Hy)}{I} yds$ expressed in terms of H.

Since the value of E for the entire span is assumed to have constant value, the equation becomes $\sum \frac{M'}{I} yds + \sum \frac{(Hy)}{I} yds = 0$ from which $H = -43{,}056$ lb. The negative value for H indicates 0 force, preventing increase in span length. The values of Hy are then entered and the M values found as the combination of M' and Hy.

Table 2 shows the computation of the effect of the shortening of the neutral axis of the frame because of direct dead-load stress. The direct stress at any point is found as the resultant of the horizontal and vertical reactions with the loads between the reactions and the point considered. A direct compressive stress is given a negative sign.

The shortening of any ds length is then Sds/AE, or the direct load times the ds length divided by the area and the modulus of elasticity. The horizontal change in span length due to shortening of the ds length, if unrestrained, is then the horizontal component of the shortening or the ratio dx/ds times Sds/AE, or Sdx/AE. For the half span, this value is —0.00084 ft. The correction in the previously computed H value is then the force which will prevent span change when the rib shortens 0.00084 ft., or the $\sum \frac{(Hy)}{EI} yds - 0.00084 = 0$, from which $H = 231$ lb.

This is a complete solution for one condition of symmetrical loading and could have been performed satisfactorily with a slide-rule.

When wheel loading is specified, it is found convenient to develop influence lines for moments at various points, for the H force and for the vertical reaction.

Table 3 gives the complete development of the moment values due to a 1-lb. load placed successively at points $4L$, $6L$ $8L$ and $10L$. Since the loading is not symmetrical in these cases, it is

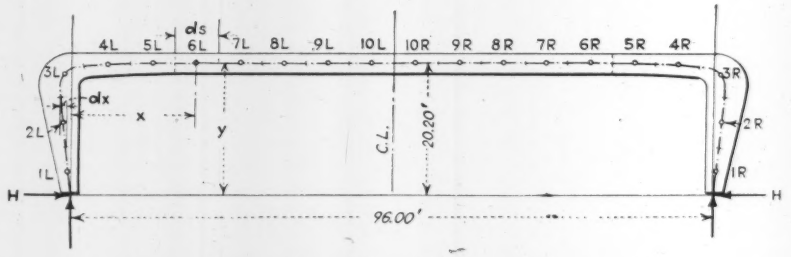


FIG. 1—BASIS OF PROCEDURE for designing a rigid frame by application of elementary mechanics.

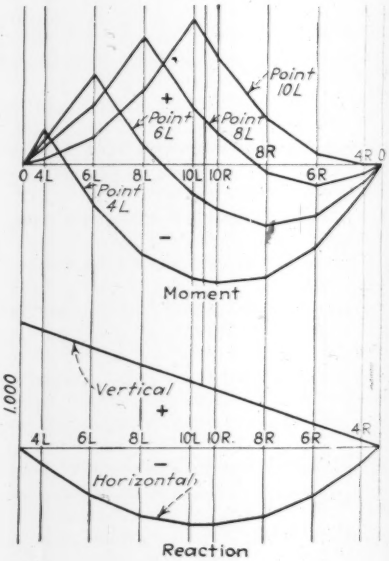


FIG. 2—INFLUENCE LINES for moment and reaction.

TABLE 1—DEAD-LOAD MOMENT CALCULATION AND FRAME CONSTANTS

Point	x	y	I	ds	$\frac{ds}{I}$	$y\frac{ds}{I}$	Hy Moment: Hy	$(Hy)y\frac{ds}{I}$	Dead-Load Moment: M'	$M'y\frac{ds}{I}$	Hy	M	Moment Due to Rib Shortening $231\ y$ (Table 2)	Corrected Moment
1	—0.40	3.75	1.01	7.48	7.405	27.769	3.75 H	104.134 H	— 24,000	— 666,456	—161,460	—185,500	+ 850	—184,650
2	—1.15	11.25	2.56	7.48	2.921	32.861	11.25 H	369.686 H	— 66,700	— 2,191,829	—484,400	—551,100	+2600	—548,500
3	—1.00	18.50	5.81	7.01	1.206	22.320	18.50 H	412.920 H	— 53,700	— 1,198,584	—796,550	—850,250	+4270	—845,980
4	5.49	19.90	2.05	6.54	3.190	63.485	19.90 H	1263.352 H	+ 273,300	+ 17,350,451	—856,800	—583,500	+4600	—578,900
5	12.03	20.10	1.36	6.54	4.809	96.657	20.10 H	1942.806 H	+ 555,600	+ 53,702,629	—865,400	—309,800	+4640	—305,160
6	18.57	20.20	1.06	6.54	6.170	124.630	20.20 H	2517.526 H	+ 790,800	+ 98,557,404	—869,700	— 78,900	+4650	— 74,250
7	25.11	20.20	1.06	6.54	6.170	124.630	20.20 H	2517.526 H	+ 979,000	+122,012,770	—869,700	+109,300	+4650	+113,950
8	31.65	20.20	1.06	6.54	6.170	124.630	20.20 H	2517.526 H	+1,120,000	+139,610,526	—869,700	+250,500	+4650	+255,150
9	38.19	20.20	1.31	6.54	4.992	100.846	20.20 H	2037.089 H	+1,214,300	+122,457,298	—869,700	+344,600	+4650	+349,250
10	44.73	20.20	1.31	6.54	4.992	100.846	20.20 H	2037.089 H	+1,261,300	+127,197,070	—869,700	+391,600	+4650	+396,250
								$15719.654H - \frac{2}{2}$		+676,834.079				
								$31439.308H$		$15719.654H + 676,834.079 = 0$				
										$H = -43,056$				
										Rib Shortening $H = +231$				
										Corrected $H = -42,839$ lb.				

necessary to tabulate values for the entire frame rather than for the one-half frame as for dead load.

Table 4 shows the ordinates to influence lines for moments at all points and the H force, being the values from Table 3 rearranged.

After plotting the influence lines (Fig. 2) the values of the moment and simultaneous H, or simultaneous vertical reaction due to wheel loads, are found in the usual manner and the $P/a \pm Mc/I$ values may be found for any section.

Moments and reactions due to temperature change are readily computed. The moment due to temperature change is Hy in which H is the force necessary to keep the span length unchanged when the rib shortens or lengthens. The amount of change of length of the rib in a horizontal direction due to a 50-deg. change in temperature is taken as $50 \times 0.0000065 \times 96 = \pm.0312$ ft. Then $\sum \frac{My}{EI} ds = \pm.0312$ ft., or $31439H = \pm.0312 \times 144 \times 30{,}000{,}000$, from which $H = \pm 4{,}280$ lb. Hy is then computed for each section as the moment produced by a temperature change of 50 deg.

Rib-shortening moments are maximum when the force H is maximum and increase the bending moment at the center of the span. For the position of the live load causing maximum moment at the center of the span the maximum H value was found to be 171,520 lb., which is 3.98 times the dead load H force for which the effect of rib shortening was computed in Table 2. The maximum effect of rib shortening is then the moment produced by an H equal to $3.98 \times 231 = 920$ lb. This is the equivalent of $920/4280 \times 50$ deg. $= 10.72$ deg. drop in temperature. It may then be considered that if the expected variation in temperature is 40 deg. below and 60 deg. above the temperature when erected, that computation of stresses produced by a variation of ± 50 deg. will take care of both temperature and rib shortening very nearly.

A horizontal tractive force of 20 per cent of the live load was specified. For the position of the live load causing maximum moment at any point the wheel loads were added together and 20 per cent used as a tractive effort, applied at 6 ft. above the top of rail. Due to symmetry of the rib, one-half of the horizontal reaction is taken at each end, and there is a vertical reaction of the tractive force times the distance from the pins to 6 ft. above the rail divided by the span length. The moment at any point is then $Hy + Vx$.

TABLE 2—DEAD-LOAD RIB SHORTENING

Point	S = Direct Load	Area Sq.Ft.	ds Ft.	$\frac{Sds}{AE}$ = Hor. Rib Shortening	Moment $= Hy$
1	—60,000	0.463	— 0.80	+ .00002	+ 850
2	—58,000	0.623	— 0.80	+ .00002	+2600
3	—69,500	0.761	+ 3.82	— .00008	+4270
4	—43,060	0.665	+ 6.54	— .00010	+4600
5	—43,060	0.561	+ 6.54	— .00012	+4640
6	—43,060	0.553	+ 6.54	— .00012	+4650
7	—43,060	0.553	+ 6.54	— .00012	+4650
8	—43,060	0.553	+ 6.54	— .00012	+4650
9	—43,060	0.643	+ 6.54	— .00010	+4650
10	—43,060	0.643	+ 6.54	— .00010	+4650

$E = 144 \times 30{,}000{,}000$ $\quad \sum \frac{Sds}{AE} = -.00084$ ft.

(For ½ span).

$15719.654H - (.00084 \times 144 \times 30{,}000{,}000) = 0$

$H = +231$

TABLE 4—ORDINATES FOR INFLUENCE LINES FROM 1-LB. LOAD

Point	Load at Point: 4L	6L	8L	10L	10R	8R	6R	4R
1L	—0.850	—1.768	—2.321	—2.503	—2.475	—2.185	—1.522	—0.496
2L	—2.504	—5.264	—6.930	—7.481	—7.403	—6.538	—4.558	—1.486
3L	—3.278	—7.936	—10.798	—11.826	—11.758	—10.458	—7.323	—2.392
4L	+2.664	—3.242	—7.215	—9.215	—9.589	—9.085	—6.608	—2.198
5L	+2.266	+1.956	—2.940	—5.844	—6.664	—7.038	—5.420	—1.849
6L	+1.879	+7.193	+1.388	—2.413	—3.678	—4.937	—4.193	—1.488
7L	+1.505	+5.928	+5.772	+1.080	—0.630	—2.780	—2.928	—1.114
8L	+1.131	+4.663	+10.156	+4.573	+2.417	—0.624	—1.668	—0.740
9L	+0.757	+3.398	+8.001	+8.066	+5.464	+1.532	—0.398	—0.366
10L	+0.383	+2.133	+5.845	+11.558	+8.511	+3.688	+0.868	+0.009
H	— .1262	— .3864	— .5475	— .6104	— .6104	— .5475	— .3864	— .1262

TABLE 3—MOMENT VALUES FOR 1-LB. LIVE LOAD

Point	1-Lb. Load at 4L: M'	$M'y\frac{ds}{I}$	Hy	M	1-Lb. Load at 6L: M'	$M'y\frac{ds}{I}$	Hy	M	1-Lb. Load at 8L: M'	$M'y\frac{ds}{I}$	Hy	M	1-Lb. Load at 10L: M'	$M'y\frac{ds}{I}$	Hy	M
1L	—0.377	— 10.469	—0.473	—0.850	— 0.323	— 8.969	—1.445	—1.768	— 0.268	— 7.442	— 2.053	— 2.321	— 0.214	— 5.942	— 2.289	— 2.503
2L	—1.084	— 35.621	—1.420	—2.504	— 0.928	— 30.495	—4.336	—5.264	— 0.771	— 25.336	— 6.159	— 6.930	— 0.614	— 20.177	— 6.867	— 7.481
3L	—0.943	— 21.048	—2.335	—3.278	— 0.806	— 17.990	—7.130	—7.936	— 0.670	— 14.954	—10.128	—10.798	— 0.534	— 11.919	—11.292	—11.826
4L	+5.176	+328.598	—2.512	+2.664	+ 4.428	+ 281.111	—7.670	—3.242	+ 3.680	+ 233.625	—10.895	— 7.215	+ 2.932	+ 186.138	—12.147	— 9.215
5L	+4.803	+464.244	—2.537	+2.266	+ 9.703	+ 937.863	—7.747	+1.956	+ 8.064	+ 779.442	—11.004	— 2.940	+ 6.425	+ 621.021	—12.269	— 5.844
6L	+4.429	+551.986	—2.550	+1.879	+14.978	+1866.708	—7.785	+7.193	+12.447	+1551.269	—11.059	+ 1.388	+ 9.917	+1235.956	—12.330	— 2.413
7L	+4.055	+505.375	—2.550	+1.505	+13.713	+1709.051	—7.785	+5.928	+16.831	+2092.648	—11.059	+ 5.772	+13.410	+1671.288	—12.330	+ 1.080
8L	+3.681	+458.763	—2.550	+1.131	+12.448	+1551.394	—7.785	+4.663	+21.215	+2644.025	—11.059	+10.156	+16.903	+2106.621	—12.330	+ 4.573
9L	+3.307	+333.498	—2.550	+0.757	+11.183	+1127.761	—7.785	+3.398	+19.060	+1922.125	—11.059	+ 8.001	+20.396	+2056.855	—12.330	+ 8.066
10L	+2.933	+295.781	—2.550	+0.383	+ 9.918	+1000.191	—7.785	+2.133	+16.904	+1704.701	—11.059	+ 5.845	+23.888	+2409.009	—12.330	+11.558
10R	+2.559	+258.065	—2.550	+0.009	+ 8.653	+ 872.620	—7.785	+0.868	+14.747	+1487.176	—11.059	+ 3.688	+20.841	+2101.731	—12.330	+ 8.511
9R	+2.184	+220.240	—2.550	—0.366	+ 7.387	+ 744.949	—7.785	—0.398	+12.591	+1269.752	—11.059	+ 1.532	+17.794	+1794.454	—12.330	+ 5.464
8R	+1.810	+225.580	—2.550	—0.740	+ 6.122	+ 762.984	—7.785	—1.663	+10.435	+1300.514	—11.059	— 0.624	+14.747	+1837.918	—12.330	+ 2.417
7R	+1.436	+178.969	—2.550	—1.114	+ 4.857	+ 605.328	—7.785	—2.928	+ 8.279	+1031.812	—11.059	— 2.780	+11.700	+1458.171	—12.330	— 0.630
6R	+1.062	+132.357	—2.550	—1.488	+ 3.592	+ 447.671	—7.785	—4.193	+ 6.122	+ 762.985	—11.059	— 4.937	+ 8.652	+1078.299	—12.330	— 3.678
5R	+0.688	+ 66.500	—2.537	—1.849	+ 2.327	+ 224.921	—7.747	—5.420	+ 3.966	+ 383.342	—11.004	— 7.038	+ 5.605	+ 541.762	—12.269	— 6.664
4R	+0.314	+ 19.934	—2.512	—2.198	+ 1.062	+ 67.421	—7.670	—6.608	+ 1.810	+ 114.908	—10.895	— 9.085	+ 2.558	+ 162.395	—12.147	— 9.589
3R	—0.057	— 1.272	—2.335	—2.392	— 0.193	— 4.308	—7.130	—7.323	— 0.330	— 7.366	—10.128	—10.458	— 0.466	— 10.401	—11.292	—11.758
2R	—0.066	— 2.169	—1.420	—1.486	— 0.222	— 7.295	—4.336	—4.558	— 0.379	— 12.454	— 6.159	— 6.538	— 0.536	— 17.613	— 6.867	— 7.403
1R	—0.023	— 0.639	—0.473	—0.496	— 0.077	— 2.138	—1.445	—1.522	— 0.132	— 3.667	— 2.053	— 2.185	— 0.186	— 5.165	— 2.289	— 2.475
		3968.680				12148.778				17212.105				19190.401		
		$31439.308H + 3968.68 = 0$				$31439.308H + 12148.778 = 0$				$31439.308H + 17212.105 = 0$				$31439.308H + 19190.401 = 0$		
		$H = -.1262$				$H = -.3864$				$H = -.5475$				$H = -.6104$		

in which V is the vertical reaction. The sign of V is opposite to the sign of H at either end.

This solution does not make the assumption that the end posts are vertical nor that the horizontal span is straight, as some of the proposed methods of analysis specify. Neither does it require the assumption that the moment of inertia follow some algebraic law of variation. These assumptions are for conditions which do not exist in the general case and only complicate the problem. It is not necessary to labor through the computation of carry-over factors, relative stiffness and fixed-end moments nor to substitute values in long formulas. The condition of loading is unrestricted. The frame may be rectangular, semi-circular, eliptical or of any shape without changing the method of solution. The span does not need to be symmetrical about its center line. The change in case of non-symmetry is to list the points for the entire frame in each computation rather than for the half span; also the solution of the H value for traction is different.

New Type of Pressure Cell for Granular Material

Disadvantages inherent in movement of the diaphragm of pressure cells avoided in a device that measures pressure through measuring increase in frictional resistance

By W. C. Huntington and E. J. Luetzelschwab

Head of Civil Engineering Department and Special Research Assistant in Civil Engineering, Respectively, University of Illinois, Urbana, Ill.

A NEW and inexpensive form of cell for measuring pressures due to granular materials has been devised in the laboratories of the Engineering Experiment Station at the University of Illinois. The important characteristic of this new cell is that no appreciable movement of the pressure diaphragm is required to register the pressure. Even a very small movement of the diaphragm toward or away from the granular material under test will completely alter the pressure conditions.

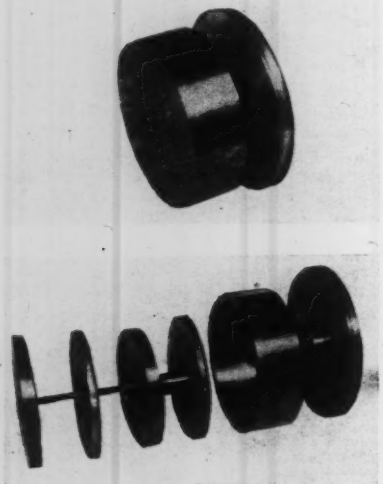


FIG. 1—THE NEW PRESSURE CELL assembled for use and, below, with its parts separated but arranged in order of assembly.

In the cell herein described the only movement of the diaphragm is the extremely small elastic deformation of the materials of which it is composed. The cell is simple, easy to operate and durable; it can be made by any skilled machinist for about $30 for both labor and material. A year's use at the university has proved it to be a very satisfactory instrument.

Simple in design

After considerable experimentation with different forms and different materials, the cell illustrated in the accompanying figures was developed. The assembled cell is shown at the top in Fig. 1, and its various parts separated but arranged in the order of their assemblage are shown below. In the latter the steel diaphragm is shown on the extreme left. Next in order are: an Oilite washer, the steel rotor, another Oilite washer, the steel cell case and the pulley that is attached to the shaft of the rotor when the cell is assembled. The basic feature of this cell is the rotor, shown black in Fig. 2, which can be made to turn between the stationary diaphragm on which the pressure acts and the stationary back of the cell. The magnitude of the torque required to turn the rotor and thereby overcome the frictional resistance between the rotor and the fixed parts of the cell on which it bears, depends upon the pressure exerted on the diaphragm. In order to keep fine particles from entering the cell when in use, the face of the cell is covered with some thin membrane such as paper.

Calibration of the cell

The cell is calibrated by placing known weights on the diaphragm and measuring the torque required to turn the rotor at a uniform speed. If the cell is in such a position that weights cannot be added to the diaphragm, the calibration may be performed by suspending known weights from the rod, which is attached to the inner side of the diaphragm and extends through the shaft of the rotor as shown in Fig. 3*a*. A spring balance, which has been calibrated, can be used in place of the suspended weights, as shown in Fig. 3 *b* and *c*. In this way the cell can be calibrated when in any position and when the face of the diaphragm is inaccessible. No difficulty is experienced in securing readings which repeat. The cell should always be calibrated in the same position that it is to occupy when in use.

The torque is applied to the rotor by means of the pulley which is attached to the shaft of the rotor. It has been found that the simplest and most satisfactory device for rotating the pulley consists of a cord wrapped around the pulley, with one end fixed to the pulley and with a spring balance attached to the other end, as shown in Fig. 4. The spring balance is pulled at a slow uniform speed, and the force required to turn the rotor is read directly on the spring balance. After a little practice, very consistent results are secured.

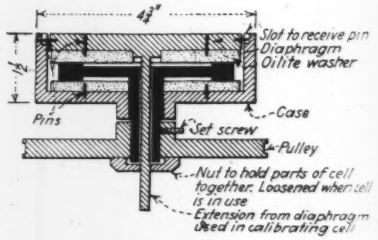


FIG. 2—CROSS-SECTION of the pressure cell, showing the relation of the rotor to the other parts.

Several devices for applying the torque to the rotor with an electric motor were tried. With such arrangements, the cell is calibrated by determining the relation between the pressure on the diaphragm and the power required by the motor in turning the rotor. Having calibrated the cell in this manner, the pressures against the diaphragm can be determined from the calibration curve. Reasonably satisfactory results were secured, but the simple spring balance described in the last paragraph proved to be the best arrangement.

In the preliminary studies rotors were

first constructed of steel, but it was found that the torque required to turn the rotor with a given pressure against a steel diaphragm was unsteady. Brass rotors gave but little better results, and various lubricants proved unsatisfactory. Finally Oilite bearing washers were placed between a steel rotor and the inner face of the steel diaphragm and between the rotor and the back of the cell, also of steel. These washers are composed of copper, tin and graphite. The diaphragm and both of the washers are kept from rotating by the small pins. The ones in the edges of the diaphragm enter slots in the cell case in such a way that they do not bind and thereby affect the operation of the cell.

It is very essential that the bearing surfaces of the rotor be machined accurately parallel, for otherwise the diaphragm will wabble and the cell thereby lose the advantage of no movement of the diaphragm during its operation. No difficulty has been experienced in securing satisfactory workmanship in this respect.

Tests have been made to determine the effect of movement of the diaphragm while grain pressures are being measured. Since the diaphragm of this cell does not move, it was necessary in making this test to move the whole cell.

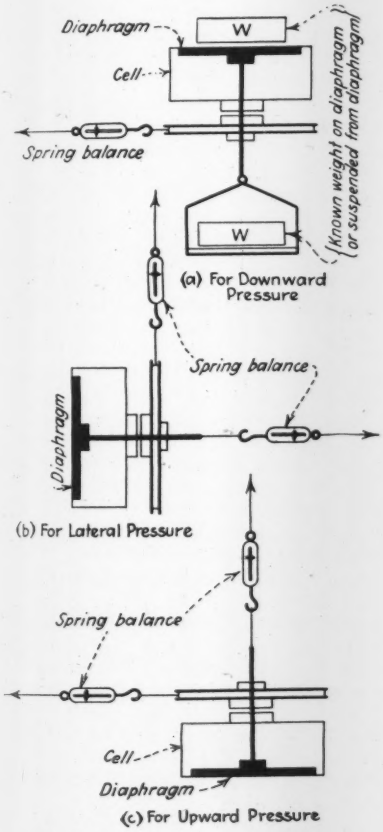


FIG. 3—CALIBRATION of the cell is conducted in the position in which the cell is to be used.

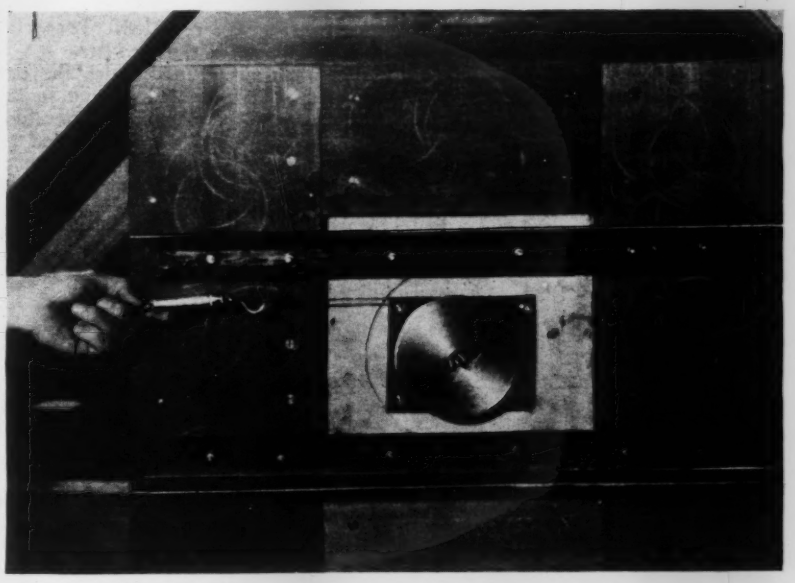


FIG. 4—TORQUE IS APPLIED to the rotor through a string secured to the pulley. A spring balance registers the pull required. This illustration shows the manner of setting the cell in the side of a wooden bin for model studies.

It was found that a movement away from the grain of as little as 0.005 in. resulted in a marked decrease in the pressure reading, and that when the cell was pushed back to its original position the pressure reading was much greater than the original value.

Since the lubrication of the friction surfaces is furnished by the Oilite bearings, it is necessary to turn the rotor about 300 revolutions with a load of about 25 lb. upon the diaphragm before using the pressure cell if more than a day intervenes between tests or if the cell is taken apart between tests. The cell should be calibrated before each test and, if possible, it is desirable to calibrate it after each test also.

Eccentric loads

In many pressure tests the pressure will not be uniform across the measuring apparatus. Therefore loads for calibration were placed eccentrically upon the diaphragm of the pressure cell to determine the effect of non-uniform distribution. In one case the eccentricity was such as to produce an intensity of pressure on one side of the diaphragm equal to about three times the pressure on the opposite side. Variations of pressure as great as this probably never occur in grain bins or in soil. No variation in calibration values was observed for this case, the magnitude of the total load being the determining factor regardless of its distribution. Calibrations were also made with the eccentricity such as to be equivalent to a straight-line variation of pressure, with the intensity of pressure on one side of the diaphragm equal to twice the average pressure and equal to zero on the opposite side. The variation of calibration values for this case was less than 5 per cent.

The effect of temperature changes was also studied. For changes of ±5 deg. F. no variation of calibration values was observed; but for a decrease of temperature from 75 to 24 deg. F. the calibration values increased about 60 per cent. Such a variation ordinarily would not be encountered, but this study indicates that a cell of this type should be calibrated at about the temperature which will prevail during a series of readings.

The cell which is here illustrated has performed very satisfactorily for unit pressures of 500 lb. per sq.ft., which produce a total pressure of about 50 lb. on the diaphragm. The total pressure on the diaphragm can be either distributed or concentrated on a small area without affecting the results. The cell may therefore be used for measuring concentrated loads. By changing the design, cells with greater capacity can be constructed if desired. The present cell has been satisfactory for all investigations undertaken at the University of Illinois. An increase in capacity may mean a reduction in sensitivity.

New studies under way

Model studies are under way to determine: (*a*) pressures exerted on the sides and bottoms of wooden bins 1 and 2 ft. square and on a concrete bin 2 ft. in diameter filled with various materials; (*b*) the effect of the rigidity of the bottom on the bottom and side pressures of model bins; (*c*) the effect of vibration on the pressures in model bins; (*d*) the side pressures in a full-sized bin; (*e*) the effect of moving the

diaphragm in and out on the observed pressures exerted by granular materials; and, (*f*) the effect of the roughness of the exposed surface of the diaphragm, or the membrane covering the diaphragm, on the observed side pressures in bins. Any variation indicated by the studies in the last item would also apply to other types of pressure, as no difficulty has been experienced in securing very close checks between tests which have been repeated. These investigations will be reported later.

The basic ideas upon which the cell is based were proposed by the senior author of this paper, and the development of these ideas was carried out by the junior author. Valuable suggestions were made by many members of the university staff. It is hoped that research in granular materials will be facilitated by using cells of this type.

Letters to the Editor

Plight of the Laborer Under N. Y. Compensation Law

Sir—During the last session of the New York State Legislature a bill was passed (An Act to Amend the Workmen's Compensation Law in Relation to Occupational Diseases — became a law on March 26, 1935, and effective Sept. 1, 1935) intended solely for the fuller protection of the working man. It is now apparent, however, that the act, instead of affording protection, is causing misery and worry for a large percentage of the individuals whom it was hoped the legislation would protect and help.

As president of George J. Atwell Foundation Corp., I should like to relate our own experience and the effects of the act on the men in our employ.

When the bill was about to be signed by the governor, notice was given us by our compensation insurance carrier that existing policies would be cancelled. We then applied to other companies for insurance and after much trouble were able to secure another policy to cover our workmen, but with the proviso that all the men be given a thorough physical examination as well as X-rays taken at our expense, and only such men as were without ailments retained. Under the circumstances we were obliged to comply with the requirements and out of 365 union men who appeared fully fit and able to work, 65 were rejected, about 20 per cent. In other words, we cannot, due to the restriction placed on the policy contract, rehire the 65 men, although our past experience has shown them to be capable and conscientious.

The men are anxious to work and earn a living for themselves and families but, due to the unforeseen ill effects of the legislation, their jobs have been taken away. Unless the matter is corrected promptly they will, through no fault of their own, become charges on the city or be obliged to accept private charity to exist. A number of these men were in our employ for many years, and it is discouraging to know that by reason of the conditions imposed by the various insurance companies we cannot give them work.

The rejected men ask questions that I am unable to answer, which is my reason for addressing you, to find out what in your opinion can be done to help these unfortunate workmen.

Some of the questions asked by the men are: Am I through—no more work? Will the city take care of me and my family? Will the state help me? Will the government give me an easy job? Can I be cured, and who will furnish medicine and doctor? Will the hospital take me in so I may be cured?

GEO. J. ATWELL.

New York, N. Y.,
Nov. 27, 1935.

The Engineer's Stake in Houses

Sir—Under the title "Rating of Property," one of the five yardsticks set up by FHA to be applied in the insuring of property, the following elements are listed, with their respective ratings in per cent:

General layout	15
Design	8
Suitability to climate	7
Livability	15
Light and air	8
Mechanical equipment	7
Accessory equipment	3
Special equipment	2
Structural soundness	20
Resistance to elements	10
Resistance to use	5

The first four elements can immediately be assigned to the field of the architect, giving him a 45 per cent stake in the total amount. The element of light and air leaves a debatable 8 per cent of middle ground, as do also the two rather vague elements, accessory equipment 3 per cent, and special equipment 2 per cent. The remaining 42 per cent belongs unquestionably to the field of the engineer. Of all the elements listed, the largest single one, that of structural soundness at 20 per cent, is also unquestionably in the field of the engineer.

It would seem that real progress in the building of houses is to be made only through a more closely coordinated effort between the architect and engineer. Such cooperative effort would result not only in better houses; those engineers and architects who are worthy of the name would build up an integrated knowledge of the science and art of building houses which would crowd out of the field those who either are unwilling or incapable of envisioning all the ingredients of a successful present-day house. Those ingredients are not all technical and, indeed, they do not include an overdose of esthetics.

At the present time, when it is predicted that this country is on the verge of a major increase in house building, and the prediction is supported not only by the figures showing the national income for 1934 but also by the steadily rising rents and prices for real estate, what will the engineers do about this big opportunity? M. KIMBALL.

New York, N. Y.,
Nov. 4, 1935.

Surveying Also Important

Sir—For a considerable number of years the writer has been engaged in engineering practice, which, in a large part, was concerned with varied surveying operations. While carrying out these engagements, close contacts were made with engineers in other fields as well as with those who spent most of their time in surveying. A large proportion of those engaged in other engineering work generally minimized the importance of the art of surveying. Although this opinion was usually expressed good-naturedly, it definitely seemed to exist, and in many instances was distinctly disagreeable.

The reason for this probably lies in the failure to differentiate between the man who has mastered the mechanical use of instruments and is able to use them under supervision and the man who executes surveys of major importance under his own initiative, devising his own checks and balances and exercising his own judgment. I have known expert surveyors who were thought to be crude and unorthodox because they used unusual experience, or injected some original idea into office computations as a means of a check.

No survey is 100 per cent perfect. For this reason, the real surveyor considers every job, large or small, as a test of his skill. In the closing line or angle of a large and extended survey the dependability of the whole structure, sometimes extending over miles, is tested by one operation. This is real suspense, ending in either grief or exultation. If it were possible for a steel frame work to stand or fall by the placing of the last rivet, the crowds watching this operation and the money gambled on it would be tremendous. A chief of a surveying party is continually in this situation.

Land surveying is often referred to as something not exactly precise. This is true to some extent in farm surveying—but suppose a man is called into the

business section of a city to lay lines for a skyscraper. These buildings invariably crowd the property line. Original survey points have long disappeared. In collecting evidence to restore them, conflicts are encountered which cannot be reconciled. There are no tested formulas to follow. It is a question of judgment, and therein lies responsibility as great as that encountered in other engineering fields.

R. D. COMSTOCK.

Pensacola, Fla.,
Oct. 19, 1935.

Rust-Resisting Steels

Sir—In the table (*ENR*, Dec. 5, 1935, p. 789) giving physical and chemical properties of foreign and domestic steels, five of the steels are marked with an asterisk, and the footnote calls for 0.20 per cent molybdenum. The asterisks refer to the chrome-copper steels, while the 0.20 per cent molybdenum refers only to Republic double-strength steels.

A footnote should also be added to the effect that "Continental mills rely on mechanical and physical tests, leaving no stipulation as to the process of manufacture and chemical analysis of steel."

This table was prepared to study the advantages of high-tensile, low-alloy, corrosion-resisting steels for bridge work. The premiums in cost vary from a few dollars per ton to double base as in the case of Cor-Ten.

An asterisk should be added to Mayari-R of the Bethlehem Steel Corp. and American Cromansil, making in all seven rust-resisting steels available for bridge work.

The Continental steels are made by the Thomas or basic Bessemer process, but certain ranges of sections are available in Siemens-Martin or open-hearth steel.

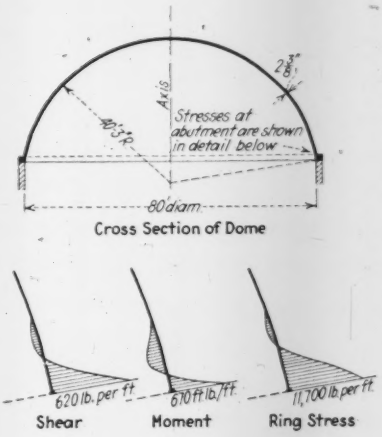
It is an interesting fact that the Little Belt Bridge recently completed in Denmark was made of German high-tensile, low-alloy, Krupp steel, and the three suspension bridges recently completed by the French Government in their colony of Madagascar were made of high-tensile, low-alloy, French bridge steel AC-54—in both cases, the element of corrosion being given major consideration. It is to be regretted that more consideration is not given to this important point in the building of our monumental bridges.

JOSEPH G. SHRYOCK,
Chief Engineer,
Belmont Iron Works.

Philadelphia, Pa.
Dec. 10, 1935.

Shell Domes of Reinforced Concrete

Sir—Two interesting discussions (*ENR*, Oct. 31, and Nov. 21, 1935, pp. 617 and 723) on the subject of concrete shell domes have given valuable data on this economical form of construction. We should like to call your attention



STRESSES in a restrained dome shell for a temperature change of 25 deg. F.

to the fact that the hemispherical dome of the Hayden Planetarium (*ENR*, July 25, 1935, p. 105) is supported on eight points only, and it is this feature that makes this dome structure rather unique. The underlying theory for point-supported domes is a quite recent development. (Dr. F. Dischinger, International Congress of Concrete and Reinforced Concrete, Liége, 1930. Dr. W. Flügge, "Statics and Dynamics of Shells," Springer, 1934.)

The more perfect the original form of a shell is maintained during the loading process, the better will be the carrying action of the shell. Every shell should therefore be stiffened in a suitable manner so as to receive only small bending deformations under the loads. Moments will be of considerable size in the shell of flat spherical domes, especially when the transition from compression to tension stresses takes place within a narrow zone. The flat dome is an intermediate between the hemispherical shell with direct stress action and the flat circular plate with bending action. A decrease of the bending moments can be accomplished by various means. Prestraining the steel bands of the abutments will reduce the moments in flat domes, especially if the prestraining is repeated during the period of shrinkage and plastic flow of the concrete.

For steep domes of sizes as built today, the prestraining does not seem practical. Bending moments due to prestraining cannot be avoided, unless it is done synchronously with the growth of the stresses during decentering operations, which will be costly. Tensile temperature stresses in the shell are hardly avoided (irrespective of prestraining), and favor the use of closely spaced reinforcing bars of small diameter. This, however, conflicts with the requirements of the prestraining, which is advantageously done with the use of turnbuckles in connection with a small number of threaded heavier bars.

In the case mentioned in a previous discussion where the abutment into which the shell is restrained is practically unyielding, the moments caused by temperature may be quite appreciable and should not be neglected. They increase of course with the increasing thickness of the shell. The size and distribution of shear, moments and ring stresses for such a dome of 80-ft. span and 2⅞-in. thickness, caused solely by a temperature change of 25 deg. F., are shown in the accompanying figure, which is reconstructed from Dr. Flügge's book, referred to above.

Mr. Hewett discussed a dome roof of 80-ft. span, 11-ft. rise and 1½-in. shell thickness, built somewhere in California. We do not consider such a structure unsafe if designed and built correctly, and there is no proof that a heavier construction with larger masses will show better behavior in an earthquake than the thin flexible structure. The determining factor limiting the boldness of such designs is the danger of buckling. It seems to us that the safety coefficient against buckling for the above-mentioned California dome can well be above eight, which surely is sufficient. Mr. Pearl states that for climatic reasons (to protect the reinforcing from corrosion), the thickness of the Hammond dome was increased above the 1½ in. necessary for statical reasons.

ANTON TEDESKO,
Engineer of Design,
Roberts and Schaefer Co.

Chicago, Ill.,
December 2, 1935.

The Late Fayette F. Forbes

Sir—The career of Fayette F. Forbes, whose death was noted briefly in your issue of Nov. 29, 1935, was noteworthy not alone for his 62 years of service in building and operating the waterworks of Brookline, Mass., but also for his work in the study and control of tastes and odors in water from filter galleries and wells, the removal of iron and manganese, and water-waste control. Together with Desmond Fitzgerald and George W. Rafter, both of whom he outlived, Forbes was one of the first waterworks engineers to use the microscope to determine the kinds and life histories of odor- and taste-improving organisms that sometimes infest water supplies. (See *ENR*, Sept. 24, 1931, p. 503; and *Journal*, New England Water Works Association, March, 1932, pp. 77-92.)

M. N. BAKER.

Upper Montclair, N. J.,
Dec. 8, 1935

A Correction

In the article on computing pipe discharges, published in our issue of Dec. 12, 1935, p. 822, the wording of the second paragraph is such as to indicate that h is the horizontal coordinate and d the vertical coordinate. The vertical coordinate is h, and the horizontal coordinate is d in the method of computing discharges there outlined.

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January 2, 1936

Warnings or Barriers?

THE SWING BRIDGE TRAGEDY of last week, caused when a bus crashed through the bridge gates into the Appomattox River in Virginia, raises serious question as to the adequacy of conventional safeguards on swing and lift bridges. Such accidents have happened before, and it is not enough to say that the bus driver was at fault, as is being claimed in this case. One of the prime duties of the engineer is to make his structure safe against human frailties, and red lights and a board painted with black and white stripes hardly constitute safety provisions. At best they are warnings. Present motor vehicles need a barrier as well as a warning. If it is considered that a rigid barrier would wreck a car and possibly catapult its occupants over the brink anyway, there is the possibility of moving the warning signs and stop signals some distance away from the bridge opening. Then a driver who crashes the gates, whether from carelessness or faulty brakes, would have time at least to stop short of disaster. The latest accident reflects no more on the Virginia authorities than it does on every state that has drawbridges protected only by conventional warning signals.

Dead and Buried

MORE THAN SIX MONTHS after its actual decease, the NRA has now been laid in its grave by an executive order terminating the organization and transferring its few surviving activities to regular departments of the government, where they are likely to have no opportunity to be harmful. While the action is not big news, its effect is reassuring, since although the code system has long been only an unpleasant memory there remained the threat of possible attempts to revive it. The Supreme Court's overthrow of the act last May had not convinced everyone that code regimentation was quite dead; in many corners in Washington, and for that matter in a few industrial groups, the hope remained that some new system of labor and price control could be established under federal auspices. But the number of those who clung to this hope visibly decreased, and the country's attitude demonstrated beyond chance of doubt that it wants to see the chapter of code control permanently closed. Whatever use may be made of voluntary trade-practice agreements in some fields, construction as well as most other industry prefers to seek progress through free competition. It is well, therefore, that all apprehension concerning revival of the NRA adventure should be finally removed.

National Differences

IN NEARLY EVERY FIELD OF ENGINEERING the differences of practice that distinguish one country from another are apt to be considered an expression of national characteristics. This is especially so in fields in which the physical conditions involved are identical or closely alike. In sewage disposal, for example, we find fundamentally the same problem everywhere, since both raw material and end results differ but little from place to place; accordingly, such divergences as those between American and English practice seem like a chance effect of national temperament or habit. But as Dr. Imhoff's comparison of American and English sewage disposal clearly brings out, the main differences result from local conditions, modified by historical evolution: small size of streams, strength of sewage, the early need for disposal and hence the extensive adoption of broad irrigation, and the crystallizing influence of the Royal Commission report of a quarter century ago. It is probable that financial limitations and native conservatism also were factors, tending to keep old plant in service even under advancing requirements. In all important respects the comparison of practice will be found to reflect logically and inevitably the influence of local conditions rather than fortuitous national trends.

Seeing Is Believing

THE RECENT ANNOUNCEMENT by the Building Trades Department of the American Federation of Labor that jurisdictional disputes are a thing of the past falls upon skeptical ears, for the construction industry has seen all too many plans for preventing these exasperating disputes fail through labor's declining to live up to its obligations and agreements. Jurisdictional disputes are as old as organized building trades, and, in recent years especially, they have cost owners, contractors and labor itself untold millions of dollars. The famous National Board for Jurisdictional Awards was regarded as the answer to jurisdictional problems when it was founded in 1919. But in less than two years the field of the board was curtailed by the carpenters pulling out because of adverse decisions; by 1927 the entire Building Trades Department had withdrawn. Sporadic attempts at jurisdictional settlement agreements have been made since then, but without success. The new plan differs little from those that have failed in the past. Only when a skeptical industry actually sees a disgruntled trade union accept an adverse decision without walking out in a huff will the plan be recognized as workable.

Serious Work Ahead

A WARNING of much significance was given by the President this week when he said that the employables over the 3½ million taken care of by the relief-works program "are definitely the responsibility of states, counties, municipalities or private charities." What this means is made tangible by current estimates of unemployment, which reach something more than 9 million, of whom perhaps 3 million are unemployed even in normal times. Thus, for the present, while the works program remains in operation, 2 to 3 million employables must be cared for by the local authorities, with the prospect that the figure will be doubled when the WPA workers are turned back to their cities and states. It is clear that serious work is ahead of the local communities in meeting this new responsibility. How they will succeed and how quickly they can reduce the burden of relief and re-employment expense depends wholly on the effectiveness of their re-employment efforts. Since industry cannot re-employ workers faster than business demand requires, employment through public improvement programs is a necessary means. It is here that administrative ability has its great opportunity, for the results

accomplished will be in proportion to the planning and management skill applied to this emergency employment. If the ill-planned and worse executed relief-works procedure of recent months is followed indefinitely, continued expense and steadily increased demoralization must be expected, and this in turn will be an obstacle to the progress of recovery.

Concrete Trusses

BRIDGE TRUSSES of reinforced concrete are rare enough that each new example occasions surprise. Was the designer merely trying to do something different? Did he have a particular leaning toward concrete at any cost? Was the bridge project enlisted in a promotional campaign for cement where part of the cost goes to advertising? Such questions are invariably asked. In the case of the remarkable concrete truss of 170-ft. span built by Pierce County, Wash., the answers seem to be covered by the bid figures, which placed the concrete design at about $36,000 and the steel design at $37,000 to $48,000, the same bidder being low on both concrete and steel. Thus, while the Pierce County bridge is a curiosity, it is also a significant one, and its design becomes a matter of moment because there are inherent difficulties that must be overcome in using reinforced concrete in triangulated structures. These difficulties largely center around the rigidity of joints and around the possible effect of deflections, torsions and stress reversals in producing cracks in the concrete. In the Pierce County bridge these difficulties were overcome first by recognizing that they existed, then by making design assumptions that either eliminated or circumvented the difficulties, and last by designing and building the structures so that the assumptions were turned into actualities. Evaluation of the degree of success attained in following this procedure must wait upon service experience.

Known by Their Works

AT THE FIRST ANNUAL MEETING of the National Society of Professional Engineers, a plan for addressing all licensed engineers by the title Engineer was made the subject of a resolution formally adopted and put into effect during the session. In this action the new society has given concrete form to a widely entertained and often expressed desire—that of finding some way to mark engineers off from their fellows, in the belief that such distinction will bring a greater measure of public recognition than has been accorded the engineering profession heretofore.

Before the present proposal goes farther, would it not be well to view the subject abstractly, and if possible a little less seriously? We ought to examine whether by such adoption of a title the profession would not make itself a trifle ridiculous and at the same time place itself on record in favor of class distinctions.

The public recognition accorded the medical profession through the use of the title Doctor is frequently cited by those who favor adoption of the title Engineer, but the Doctor applied to a physician is of quite different origin and significance from the term now proposed. The physician's Doctor is a survival from the time when the general public's contact with the holders of scholastic degrees was limited almost exclusively to physicians. Today the title Doctor no longer sets apart the licensed physician or surgeon, as engineers well know, for many engineers themselves take pride in displaying a Doctor's degree.

Engineers above all are supposed to be logical; do they propose to follow the present plan to its logical conclusion with Physician Jones, Dentist Smith, Chiropractor Brown—or Barber Cavello, for that matter, for barbers too are licensed in the interest of public safety?

But to bring the subject more nearly home: Just who is it within the field of construction that is to be distinguished by the title Engineer? Is the scholastic significance of the title to be emphasized, as the preamble to the resolution adopted at Columbus would indicate, or is the distinction to be reserved to the licensed or registered engineer? If the former, is the title to be applied to the graduate engineer who goes into research or into contracting and does not take out a license as an engineer? If the latter, assuming that the graduate engineer who goes into research or into contracting rises to a position of prominence in his chosen work, is the profession demanding of the public that it call these two men just plain Mister and yet requiring that it accord the title Engineer to the mediocre designer who has just managed to obtain a license? Will the use of the title Engineer in this case add distinction to the profession? Will it add measurably to protection of the public against charlatans?

Titles have been looked upon with disfavor in this country ever since it was founded by men who had learned through hard experience that Lord So-and-So could be a worse scoundrel than plain John Jones. Class distinctions also are abhorrent to the American people—and whether the proponents admit it or not, adoption of the title Engineer by licensed engineers would set up a class distinction in the selfish hope that the class would benefit.

When those who now favor the plan to adopt a class title have had an opportunity to consider all its ramifications, we believe that they will quickly ask for its abandonment. Works, not titles, brings public recognition. If the profession as a whole is to attain more public recognition it must raise the standards of the service of the individual to the community. How many engineers contribute of their time or experience to the advancement of the community in which they live? Far too few; and yet there is no better way to stimulate public recognition of what the profession as a whole means to the community than through the types of public service that give the engineer as an individual an opportunity to point out how a multiplicity of community problems can best be solved by the application of engineering principles.

Public knowledge of what engineering is lags far behind the profession's accomplishments. But the profession by its rapid growth in the past few decades has drawn into its fold many men of mediocre ability and many whose only interest in engineering is what they can get out of it. Because of this the profession lags in attaining the ideal professional status that might warrant some special public recognition. The profession, therefore, must first set its own house in order.

The old adage still holds: "By their works ye shall know them." A few engineers will be known by the great monuments they have helped to build, but the large majority, if they would increase public recognition of the profession, must make themselves known not by a self-assumed title but by what they as individual citizens do for the community of which they are a part.

CURRENT NEWS

Florida Canal

Engineers and geologists find that canal will not have serious effect on water supply of Florida

GROUND-WATER changes in Florida due to the proposed sea-level ship canal across the state will be only local, without deleterious effects upon municipal water supplies or agriculture, according to a report submitted to the War Department by a special board of geologists and engineers now making an exhaustive study of the problem. Personnel of the board is as follows: Clarence E. Boesch, Frank C. Carey and Malcolm Pirnie, engineers, Sidney Paige and E. B. Burwell, geologists. The commission's report is not final, as further studies are to be made on several phases of the question. The conclusions stated, however, are expected to stand without qualification.

Two sedimentatary strata

Underlying the Florida peninsula are two principal sedimentary strata, gently arched, the lower of porous limestone, the upper of less porous sands, clays, marls and sandy limestones. Total thickness of the two strata is about 4,000 ft. The upper formation has been eroded away over an oval area 120 miles long and 50 miles wide on the northwest side of the peninsula at the crest of the low dome. The route of the canal traverses the southern part of this oval.

Both surface and sub-surface drainage follow the same general pattern, flowing away from two topographic "highs" located 75 miles south and 40 miles north of the canal route. Between these points there is a saddle of lower ground from which the flow is to the east and west through the Ocklawaha and Withlacoochee river systems. The canal crosses the peninsula about where the drainage systems from the north and south meet and diverge to the east and west.

Because of the permeability of the soil much of the rainfall is absorbed into the ground, increasing the ground water reserves in both the upper and lower strata, Salt water lies below the fresh water reservoir, being depressed below sea level to depths dependent upon the height of the fresh water table above sea level, the ratio being 38 ft. of fresh water below sea level to every foot of fresh water above.

Underground flow

The water-bearing strata contain many eroded channels of enormous capacity which act as drains just as do the surface streams. The flow from all subterranean passages and part of the surface flow is surplus water above the capacity of the underground storage. The canal line is located at the point of maximum discharge of this surplus water.

The commission found that only 27 miles of the 195-mile length of the canal will have any appreciable effect on the ground-water level or upon artesian pressures. This section, between Silver Springs and the Gulf, will traverse the underground reservoir where it is not subject to artesian pressure and will draw down the water table to sea level immediately adjacent to the waterway. North and south of the cut the water table will rise to about its present height in a distance of from 10 to 15 miles. Wells within this distance will require deepening.

East of Silver Springs there will be a diminution of the artesian pressure, this effect being greatest along a line extending due east to the Atlantic, and diminishing north and south of such line. The territory so affected has already experienced difficulty from low pressure and from salt water encroachment. Further studies of this problem are to be made and the commission reserves its opinion as to effects in this area.

Effect on springs unknown

Further investigations must also be completed before conclusions can be reached as to the effect of the canal upon springs and lakes contiguous to the route. Should it appear that Silver Springs, Blue Springs, or others would be greatly affected by the lowering of the water table in the vicinity of the waterway the commission believes that regulatory works could be constructed to minimize the danger. It is pointed out that the large concentrated discharge into the canal at these points would require some method of control in any event.

Individual attention was given to the municipal water supply systems of the major Florida cities and it was found that in no case would there be any appreciable effect due to the canal. The same conclusion was reached in regard to possible effects on agriculture.

The Secretary of War has approved the allotment of $20,000 for supplemental examinations and surveys in the Ocala district.

These are to include the preparation of reports on examinations and surveys authorized by Congress to determine the flow of and the degree and extent of salt water intrusion in the St. Johns and Withlacoochee rivers; miscellaneous examinations; examinations and surveys for which specific allotments are not available; and reports pertaining to bridges and other structures.

Merritt Parkway Plan Completed

Plans and specifications for the Merritt Parkway, which will connect Greenwich and Trumbull, Conn., a distance of 38 miles, and which will run parallel to the present U. S. Highway No. 1, with which it connects at Trumbull, have been completed, according to the Connecticut state highway commissioner. Some delay in the call for bids will ensue, however, as it is yet undecided whether to let contracts in large units or to split them up into several smaller units. The total cost of the project will be about $15,000,000. Fairfield County has sold a $6,480,000 bond issue, proceeds from which are to go for purchase of land and construction of the parkway.

PWA Housing

Report to the President shows forty-eight of fifty projects in some stage of construction

IN A REPORT to the President on the status of housing projects, Administrator Ickes, on Dec. 23, indicated that 48 of the 49 projects eligible for qualification under the PWA Housing Division program have been definitely committed to execution by award of contract or starting of work on a force account basis. Of the 50 projects only 49 were ever considered eligible for qualification under the Dec. 15 deadline, since the Louisville, Ky., project has been held in abeyance since December, 1934. This project has been the basis of litigation for the right of the government to exercise eminent domain and is now before the U. S. Supreme Court. This project has only been held in the Housing Division program as a technically active project. The award of the contract on the Detroit, Mich., project has been temporarily held up pending enactment by the city council of an ordinance providing for the vacating of streets on the housing site.

Over $120,000,000 allotted

The Housing Division program comprises 37 projects, amounting to $101,028,000 allotted from the 1935 emergency relief appropriations and 13 projects amounting to $28,697,100 from 1934 funds, making a total of 50 projects for which a total of $120,725,100 has been allotted. These are being built under a grant of 45 per cent of the cost of the project and a loan covering the remainder which is repayable over a period of 60 years at 3 per cent interest.

Seven limited dividend projects, undertaken with the aid of federal loans, are now completed and occupied. Of the 48 projects, 12 require demolition before further work can be undertaken. In addition, foundation contracts have been awarded for 23 projects and general construction contracts have been let on three other projects. Work on the Anacostia project, Washington, D. C., has been temporarily suspended.

New Sanitary Districts Formed in Illinois

As a result of the activities of the recently established Illinois State Sanitary Water Board two new sanitary districts have been formed, one for Danville and one for Lincoln, both of which propose to build sewage treatment works. J. E. Epler and J. M. Deal are the respective presidents of the two districts. C. W. Klassen, acting chief sanitary engineer of the state board of health is acting technical secretary of the sanitary water board which is made up of the directors of public health, conservation, agriculture, public works and buildings, and a manufacturer.

New England Engineers Reinstated by PWA

Leslie A. Hoffman, state PWA engineer for Rhode Island, William Albrecht and Frank B. Perry, Providence engineer-examiners, were restored to duty by Harold L. Ickes, Administrator of the PWA on Dec. 23. It was stated that none of the three was guilty of wilful irregularities in the awarding of contracts to the New England Electric & Machine Co., of Pawtucket, for the illumination of the state airport in spite of a lower bid. The engineers were suspended on Nov. 19 as a result of complaints launched by an unsuccessful bidder on the project (*ENR*, Nov. 14, p. 695).

Actions criticized

Administrator Ickes offered criticism in his published message to Mr. Hoffman on the ground that lack of judgment was shown in assuming the unnecessary responsibility of receiving bids and bid bonds and of designating the lowest responsible bidder instead of allowing applicants to make the designation and then approving or disapproving the action. Bad judgment was also shown, the communication stated, in allowing one of the bidders to withdraw his tender without penalty. No fraud or collusion was shown, and restoration therefore followed.

In exonerating Mr. Albrecht from any wilful wrongdoing, the Administrator pointed out that the suspended engineer was subject to censure for discussing the financial statement of one of the bidders with a salesman for an electrical firm which had a potential interest in that bidder's securing the contract. He stated that nothing in the record of the case tends to connect any of the PWA officials or employees with any fraud, collusion or other illegality in connection with the contract award. Mr. Perry was exonerated and restored without censure. A Rhode Island court recently sustained the manner in which approval was given to the awards.

Navy Civil Engineers Promoted

Eleven officers of the Civil Engineer Corps of the U. S. Navy were selected for promotion on December 26. Among those selected for promotion were Geer A. Duncan, assistant to the Chief of the Bureau of Yards and Docks, Navy Department, and Henry G. Taylor, public works officer, Norfolk Navy Yard, both of whom were recommended for promotion from commander to captain. Lieut. Commander Kendal B. Bragg, public works officer, Navy Yard, Charleston, S. C., was recommended for appointment as commander.

Lieutenants (junior grade) who were recommended for promotion as lieutenants are: Charles L. Strain, Naval Air Station, Pensacola, Fla.; Robert H. Meade, Marine Barracks, Quantico, Va.; Joseph D. Jelley, Jr., Naval Operating Base, Norfolk, Va.; Thomas L. Davey, public works officer, Marine Barracks, Parris Island, S. C.; John E. Faigle, Norfolk Navy Yard; Wesley H. Randig, Navy Yard, Cavite, P. I.; Archibald D. Hunter, Navy Yard, New York; Hunt V. Martin, Bureau of Yards and Docks, Navy Department, Washington.

CALERO DAM, one of five rolled earthfill dams now under construction for the Santa Clara Valley Water Conservation District in California, is a 604,000-cu.yd. structure. On all these dams particular attention is being paid to compaction of the material, which is deposited in layers, sprinkled lightly and then worked over with petrolithic rollers as shown. At the extreme right is a truck carrying floodlights served by a generator driven by a gasoline engine. Because of the haste to get the dam completed between rainy seasons and in time to store this winter's runoff, the work is being done in three 8-hr. shifts. Tractor in left background is dragging boulders down the face of the dam.

International Conference To Discuss Soil Mechanics

A conference for the discussion of soil mechanics and foundation engineering will be held by the International Conference on Soil Mechanics and Foundation Engineering at Harvard University, Cambridge, Mass., from June 22 to 26, 1936. The primary purpose is to make available detailed existing information which is of value to the soil engineer, but which, for various reasons, has remained unpublished or unavailable, and to provide for better coordination of future work.

The conference will be devoted to formal discussion of papers. In order that a sufficient amount of material will be available, engineers are requested to send in contributions which will be made available to interested members sufficiently in advance to permit study and preparation of discussion and abstracts of all the papers will be made available to members attending the conference.

No restrictions on the number of contributions, provided they are within the scope of the conference, have been made by the organizing committee. Anyone interested in the conference is invited to attend and to contribute papers. The committee has limited the topics to be considered to the following divisions: reports from soil mechanics laboratories on testing apparatus, technique of testing and investigations in progress; exploration of soil conditions and sampling operations; regional soil studies for engineering purposes; soil properties (particularly shearing resistance and consolidation characteristics); stress distribution in soils; settlement of structures; stability of earth and foundation works and of natural slopes; bearing capacity of piles; pile loading tests; earth pressure against retaining walls, excavation sheeting, tunnel linings; ground water movement and seepage; soil problems in highway engineering; methods for improving the physical properties of soils, including constructing and compacting earth fills; modern design and construction of foundations.

Karl von Terzaghi, professor, Technische Hochschule, Vienna, Austria, well known authority on soil mechanics, is president of the conference. Harry E. Clifford, dean of the Graduate School of Engineering, Harvard University, is chairman of the organizing committee, and Arthur Casagrande is secretary.

Lenox R. Lohr Made NBC President

Lenox R. Lohr, manager of the Chicago World's Fair and former editor of the *Military Engineer*, has been named as president of the National Broadcasting Co. to succeed Merlin H. Aylesworth, who has resigned. Mr. Lohr was graduated from Cornell University in 1916 with degrees in both mechanical and electrical engineering, and in the same year was commissioned a lieutenant in the Coast Artillery. The following year he became a captain in the Corps of Engineers and in 1918 became a major. After the war, Major Lohr was graduated from Claire College, London, and from 1919 to 1923 served as instructor in the Army Engineer School. He then became executive secretary of the Society of American Military Engineers and editor of its journal.

Brief News

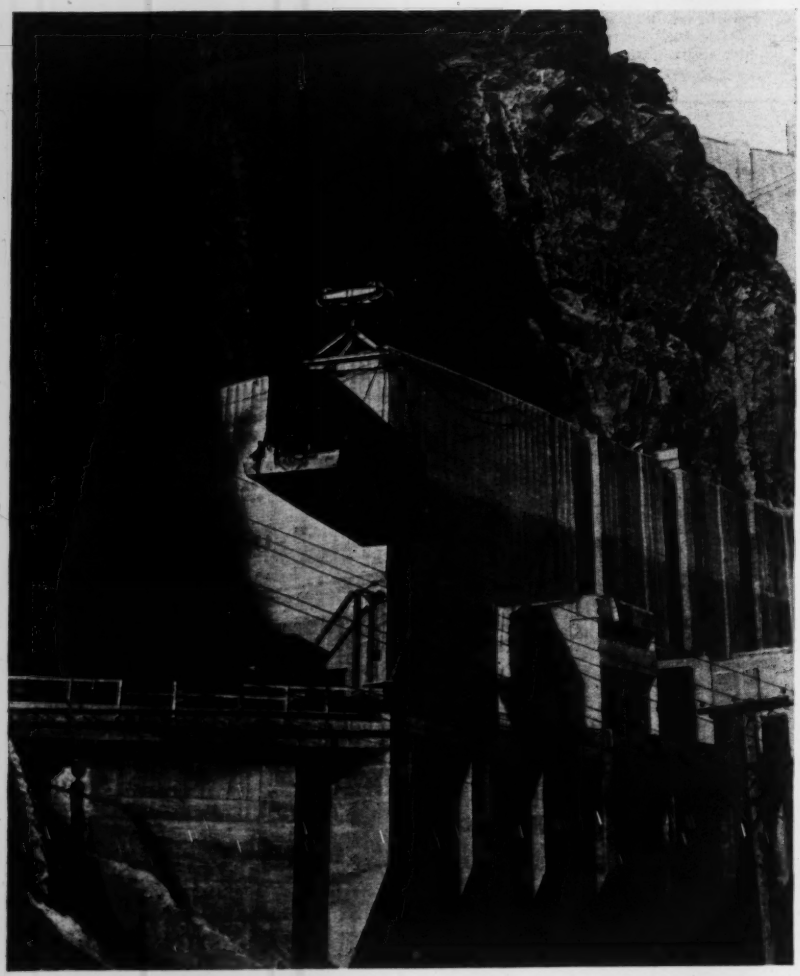
THE U. S. SUPREME COURT on Dec. 23 granted the plea of the state of Wyoming that the state of Colorado be made a co-defendant with it in the suit by the state of Nebraska to have the rights of the states to the waters of the North Platte River adjudicated. In granting the plea the court ordered Colorado to answer the suit by March 2.

A RELIEF MAP of the Florida ship canal project is to be added to the Florida display in Rockefeller Center, New York City. U. S. Army engineers have prepared the relief map at a cost of about $1,000. The relief map will be accompanied by a diorama depicting construction scenes along the canal.

A RECOMMENDATION that New Jersey buy all of the railroad lines in the southern part of the state to modernize and operate them publicly has been made by the South Jersey Transit Authority. The recommendation calls for the public ownership and operation of railroads in Camden, Burlington, Gloucester, Cumberland, Salem, Cape May, Atlantic and Ocean counties and a part of Monmouth County. The Authority believes that by substituting diesel-electric power for steam power that the lines can be profitably operated. Both the Pennsylvania and Jersey Central own railroads in that part of the state.

DISCUSSION has again been commenced on the possibility of building a new outlet from agricultural Manitoba to Hudson Bay by the construction of a railroad directly north from Winnipeg. This would shorten the distance from Winnipeg to the new port of Churchill from 998 miles to 663 miles.

THE OHIO SUPREME COURT held that the Muskingum watershed conservancy district has the right to condemn property for the relocation of railroads within its jurisdiction. Trustee for the Canton Boy Scouts' Association, contended the district could not condemn land for such a purpose and appealed from the decision. The Supreme Court upheld the lower courts.



A WHOLE BOX car goes down to the power house at Boulder Dam. Part of the equipment of the permanent 150-ft. cableway at the dam is a transfer platform by which standard-gage railway cars containing generator machinery can be lowered 800 ft. to the platform shown in the foreground on which are rails running into the power house.

$6,750,000 Provided For St. Louis Park

Relief funds made available to purchase land, remove buildings and start work on Jefferson Memorial Park

THE President by an executive order issued on Dec. 21, allocated $6,750,000 of Emergency Relief Act funds to be used to acquire a 37-block area along the river front at St. Louis, Mo., and to clear and develop the area as a historic site of national significance. The area is to be known as the Jefferson National Expansion Memorial. The city of St. Louis has agreed to contribute $2,250,000, and with the $9,000,000 thus made available the National Park Service is to start work on the project which is estimated to cost $30,000,000.

Development of the Mississippi waterfront in St. Louis between the Eads Bridge and the Municipal Bridge and as far back as Third St. has been under consideration for some years past. Last September, under an enabling act passed by the state legislature, the city approved a bond issue of $7,500,000 to be used on a one to three ratio to match government funds, provided the federal government would participate in the undertaking. The President's order cites the declaration by the 74th Congress that the preservation of historic sites should be national policy. Under authority of this act of Congress he finds the lands situated on the west bank of the Mississippi River at and near the site of old St. Louis possess exceptional value as commemorating the history of the United States. The executive order lists the many historic events connected with the site, including the transfer of the Upper Louisiana Purchase to the United States during Jefferson's administration.

Plans for the development of the site still are indefinite especially as the National Park Service is to take it over. The money now available is to be used to purchase the site, clear the land of building and start the park development.

Work To Be Resumed On Payette Project

Secretary Ickes has ordered resumption of work on the $1,000,000 Payette Division of the Boise, Idaho, federal reclamation project after a survey showed an available supply of labor in Emmett, Pocatello and other nearby communities. Work will be resumed immediately on the project. The work had been temporarily halted because of a report that insufficient unemployed labor was available in the vicinity of project for which a $1,000,000 allotment had been made from relief works funds.

"In view of the fact that a recanvass of the labor situation discloses that an adequate supply is available within a reasonable transportation radius of the project," Secretary Ickes said, "work will be resumed."

The Reclamation Bureau called for bids on construction of four tunnels of the Black Canyon conduit, which will be the main canal for the division, Dec 2. The bids are now being studied and awards are expected soon.

Changes Made in Organization Of McGraw-Hill Publishing Co.

At a meeting of the board of directors of the McGraw-Hill Publishing Company, Inc., held on Dec. 27, 1935, James H. McGraw, the founder of the company and its head for more than fifty years, resigned as chairman of the board and was elected honorary chairman. He will remain as a member of the board.

James H. McGraw, Jr., who has been connected with the company for the past twenty years, was elected chairman of the board. He has served as treasurer and was executive vice-president and vice-chairman of the board at the time of his election.

Malcolm Muir, president of the company since 1928, continues in that capacity.

H. S. Earle, Good Roads Pioneer, Dies

Horatio Sawyer Earle, first highway commissioner of Michigan, died at his home in Detroit, on Dec. 25. He was 80 years old at the time of his death.

In 1895 Mr. Earle became chairman of the Michigan Good Roads Committee and from then on became actively interested in improving highways in Michigan. In 1901 he was selected as chairman of the Michigan Highway Commission and two years later became state highway commissioner and held this position until 1909. His efforts in advocating good roads have been recognized by the creation of the Earle Memorial Highway from Detroit to Port Austin. Mr. Earle was born in Mount Holly, Vt., and in 1890 became the Detroit representative of the North Wayne Tool Co. He later became president of the company.

Second Unfavorable Ruling For Buzzard's Roost Project

A second unfavorable ruling by Federal Judge H. H. Watkins on Dec. 23 once more denied the legal right of PWA to make a combined loan and grant of $2,800,000 to Greenwood County, S. C., for the construction of a publicly owned hydro-electric plant at Buzzard's Roost on the Saluda River.

On April 23 Judge Watkins held that the project would be, in effect, a proprietary rather than a public enterprise (*ENR*, May 16, p. 720). He did not challenge the right of the government to build utilities or control rates, but stated that Congress could not legislate for a local enterprise under the general welfare clause of the Constitution.

The county had entered into an agreement with PWA, by which the latter was to fix the rates. The Duke Power Co., which has lines in that territory, brought action against PWA and the county, charging rate fixing was solely in the province of the state and that the proposed project would set up rates which would destroy the company's business. Judge Watkins voided the contract and restrained the PWA. Before the case was appealed, a new contract between the county and PWA was drawn. The case once more came before Judge Watkins and he held that the new contract failed to surmount the objections raised to the first.

SOCIETY CALENDAR

AMERICAN ENGINEERING COUNCIL, annual meeting and conference of Secretaries of Engineering Societies, Washington, D. C., January 9-11.

ASSOCIATED GENERAL CONTRACTORS OF AMERICA, annual meeting, Miami, Fla., January 13-15.

AMERICAN SOCIETY OF CIVIL ENGINEERS, annual meeting, New York City, January 15-18.

AMERICAN ROAD BUILDERS' ASSOCIATION, annual convention and road show, Cleveland, Ohio, January 20-24.

CONSTRUCTION EQUIPMENT ASSOCIATION, first annual meeting, Cleveland, Ohio, January 20-24.

CANADIAN CONSTRUCTION ASSOCIATION, annual meeting, Hamilton, Ont., January 21-23.

NATIONAL PAVING BRICK ASSOCIATION, annual meeting, Columbus, Ohio, January 29-31.

ENGINEERING INSTITUTE OF CANADA, annual meeting, Hamilton, Ont., February 6-7.

AMERICAN SOCIETY FOR TESTING MATERIALS, regional meeting, Pittsburgh, Pa., March 4.

MIDWEST POWER ENGINEERING CONFERENCE, Chicago, Ill., April 20-24.

NEW YORK STATE SEWAGE WORKS ASSOCIATION, annual meeting, New York City, January 14-17.

LOUISIANA ENGINEERING SOCIETY, annual meeting, New Orleans, La., January 24-25.

ASSOCIATION OF HIGHWAY OFFICIALS OF NORTH ATLANTIC STATES, annual meeting, Atlantic City, N. J., February 12-14.

SOUTHWEST ROAD SHOW AND SCHOOL, Wichita, Kan., February 25-28.

KANSAS CITY SECTION, American Society of Civil Engineers, recently elected the following officers: ROBERT P. WOODS, president; T. D. SAMUELS, JR., J. F. BROWN, vice-presidents; A. B. TAYLOR, secretary and treasurer.

ALABAMA SECTION, American Society of Civil Engineers, on Dec. 20 elected the following officers: HARRY H. HENDON, president; R. D. JORDAN, A. C. POLK, vice-presidents; E. E. MICHAELS, secretary and treasurer.

Personals

GEORGE L. CLARK, formerly division engineer for the Missouri state highway department, is now associated with the U. S. Bureau of Public Roads with headquarters in Washington, D. C.

CHARLES P. SEGER, resident engineer for the Middle Rio Grande Conservancy District at El Vado Dam, N. M., has accepted a position as resident engineer on Buchanan Dam, Tex., for the Colorado River Authority.

J. M. YOUNG, captain in the Corps of Engineers, who formerly had been in charge of Missouri River work in the Omaha district has been assigned to supervise WPA projects in Nebraska. His headquarters will be in Lincoln.

J. R. GRESSITT, general superintendent of the Northwestern division, Pennsylvania R.R., has been promoted as acting chief engineer of maintenance of way of the Western region with headquarters at Chicago. Mr. Gressitt succeeds PORTER ALLEN who is on leave because of illness. Mr. Gressitt has been with the Pennsylvania since 1908. Mr. Allen has been chief engineer of the Western region since 1927.

F. R. GERARD, superintendent of the Philadelphia division, Pennsylvania R.R., will succeed Mr. Gressitt as general superintendent of the Northwestern division. Before he became superintendent of the Philadelphia division, Mr. Gerard had been division superintendent of the Long Island R.R. F. W. STOOPS, superintendent of the Chicago terminal division, will succeed Mr. Gerard, and will in turn be succeeded by F. R. REX, superintendent of the Logansport division. W. D. SUPPLEE, division engineer of the Philadelphia terminal division, will take the post left vacant by Mr. Rex.

JOSEPH A. MACDONOUGH, Cooperstown, N. Y., has been appointed senior WPA civil engineer for the Binghamton district. Prior to this Mr. MacDonough was an engineer in the Pennsylvania state highway department.

ALEXANDER GRAY, who was chief engineer and general manager of the St. John N. B., Harbor Commission, until the abolition of that commission, has been appointed acting manager of the port of St. John, by the Central Harbor Board, of Canada. Under a new system of harbor control, the Central Harbor Board was organized to direct all the ports of Canada, replacing the various port commissions, which had been functioning previously. Also on the new board is COL. A. E. DUBUC, chief engineer of the dominion department of railways and canals.

GEORGE P. STOWITTS has been appointed chief engineer of the inspection division of PWA. Mr. Stowitts will fill the position left vacant by CAPT. J. G. GHOLSTON, who has been appointed Director of the PWA engineering division.

For twenty years Mr. Stowitts held various engineering positions with the New York Central Railway. He has also been a consulting engineer to the corporation counsel of New York City, an engineer for the Seaboard R.R., and also engineer of design and engineer of construction for the $41,000,000 station constructed by the Cincinnati Union Terminal Co. For the last two years he has been the state engineer-inspector at Des Moines, Iowa, for the PWA.

Obituary

EMMETT RATLIFF, city engineer of Fayetteville, Ark., died at Oteen, N. C., on Dec. 17. Mr. Ratliff was graduated from the University of Arkansas in 1908.

EDWARD A. MCKINNEY, superintendent of the Barletta Construction Co., Boston, Mass., died at his home in that city on Dec. 8. He was born in Brighton, Mass., 58 years ago and was well known in the filtration field.

J. J. PARKS, 64, president of the Parks Construction Co., Omaha, Neb., died at his home in that city on Dec. 13. Mr. Parks, who had been a paving contractor, had been in the construction business for the past 42 years.

ROBERT L. PROCTOR, SR., 62, Nashville, Tenn., contractor, who was engaged in the building of the PWA low cost housing development there died Dec. 6. He was formerly general manager of the Nashville Roofing and Paving Co., and later became head of R. L. Proctor Co.

JAMES R. BRODERICK, 65, architectural engineer who designed many of the buildings at the Pan American Exposition,

Buffalo, and the St. Louis Exposition, died Dec. 27 at his home in Buffalo, N. Y. He formerly was a member of the firm of Broderick and Wing. During the War, he served in an advisory capacity on the engineering staff which constructed the Army cantonment at Atlanta, Ga.

JOHN F. O'DONNELL, director of the Indianapolis Water Co., died Dec. 25 at the age of 72. He began work with the company in the distribution system 49 years ago, becoming superintendent in 1911 and business agent and director in 1923.

HARRY E. BARLOW, chief engineer of the Chicago, St. Paul, Minneapolis & Omaha Ry. Co., died at his home in St. Paul, Minn., Dec. 11. Mr. Barlow was born at Baraboo, Wis., in March, 1880. He was educated at the public schools and was graduated from the University of Minnesota as a civil engineer in 1903. Mr. Barlow began work for the Omaha Ry. Co. in the summer of 1896, spending his vacations in this manner until his graduation when he was made assistant engineer, a position that he occupied until March, 1920, when he was appointed chief engineer.

FRANK E. PRATT, civil engineer during the past fifteen years for the Dexter-Carpenter Coal Co., New York, died at his home in Holidaysburg, Pa., Dec. 11, at the age of 63. After attending Cornell University, Mr. Pratt, in 1892, began his engineering work as an instrument man with the Scranton Gas & Water Co. and the following year became assistant city engineer of Carbondale, Pa. He then spent five years as assistant to the chief engineer of the Scranton Gas & Water Co., and from 1899 to 1903 was chief engineer for the Tintern Manor Water Co., Long Branch, N. J. In 1904 Mr. Pratt became chief engineer on the Jay St. Terminal, Brooklyn, N. Y. He then became chief engineer for Arbuckle Bros., importers, Brooklyn, and held this position for fourteen years, when he left to organize the firm of Pratt & Moore, consulting engineers. He later became engineer for the Dexter-Carpenter Coal Company.

WILLIAM ARTINGSTALL, consulting engineer to the department of public works, Chicago, died Dec. 25, at the age of 61, in that city. Born in Chicago, he was graduated in civil engineering from Cornell University in 1899 and for two years was resident engineer of the Sanitary District of Chicago and later served four years as a designing engineer. In 1907 he became engineer for the Chicago Harbor and Subway Commission. Following service during the war as engineer to the U. S. Housing Board he rejoined the city in the capacity of consulting engineer.

CONSTRUCTION STATISTICS FOR THE WEEK

STATE and municipal awards, particularly public buildings, highways and bridges are responsible for this week's engineering construction volume of $36,736,000. Although for a 4-day week due to New Year's, and smaller than the two preceding record weeks, this volume is larger than the average week for 1935. It is made up of private awards, $1,521,000; public, $35,215,000; federal, $1,120,000 and state and municipal, $34,095,000. Corresponding values last year are: total, $42,150,000; private, $1,945,000; public, $40,205,000; federal, $25,616,000; and state and municipal, $14,589,000. This year's awards are distributed over a larger number of projects.

The classes of construction represented in this week's awards are: waterworks, $1,986,000; sewerage, $1,535,000; bridges, $5,038,000; streets and roads, $10,540,000; earthwork, waterways, $801,000; public buildings, $15,019,000; commercial buildings, $605,000; and industrial buildings, $862,000.

The larger awards for the week include: fire and police stations, Chicago, Ill., $588,000; junior high school, Reading, Pa., $500,000; senior high school, Rock Island, Ill., $692,000; school, Butte, Mont., $679,000; highway awards by Illinois, $891,000; by Louisiana, $852,000 and $528,000; by New Mexico, $542,000 and $444,000; by New York, $919,000; by Texas, $1,131,000; bridges by Illinois, $448,000; from Galveston Island to Virginia Point, Galveston, Tex., $1,675,000; over Neches River, Port Arthur, Tex., $829,000; overpass in King County and Nisqually bridge in Pierce and Thurston Counties, Washington, $931,000.

State and municipal bond sales for the week total $9,834,000 and corporate issues, $960,000.

CONTRACTS

(Thousands of Dollars)

	Weekly Average Jan. 1935	Prev. 4 Weeks	Week Jan. 2 1936
Federal Government	$3,979	$14,735	$1,120
State and municipal	15,399	37,038	34,095
Total public	$19,378	$51,773	$35,215
Total private	5,977	7,103	1,521
Week's total	$25,355	$58,876	$36,736
Cumulative to date:			
1935	$42,150,000	1936	$36,736,000

NEW PRODUCTIVE CAPITAL

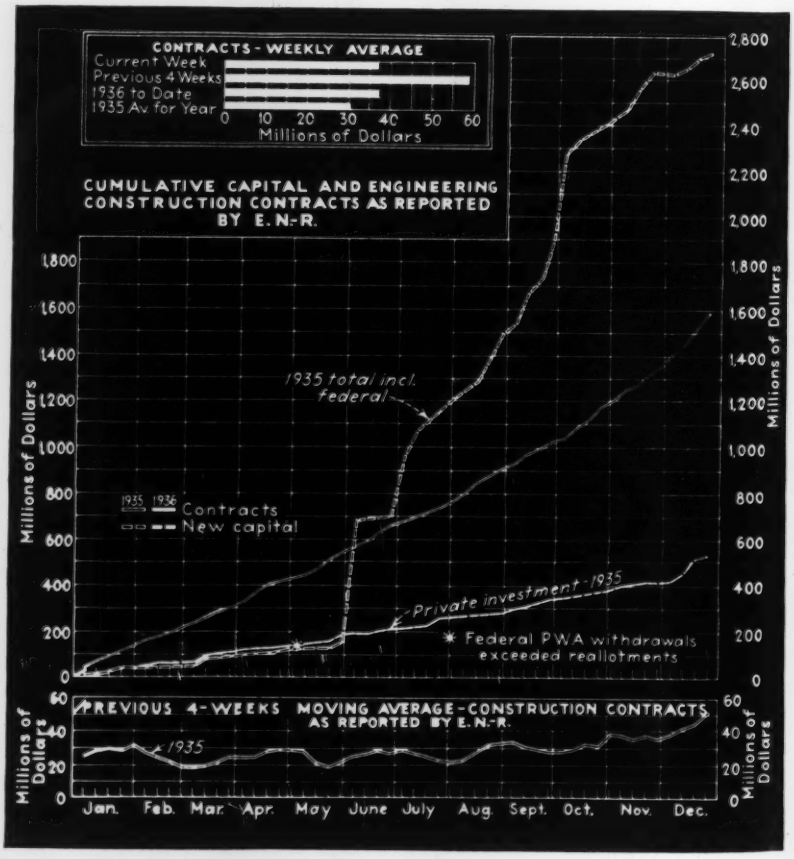
(Thousands of Dollars)

1936	Week Jan. 2	Cumulative
State and municipal	$9,834	$9,834
Corporate issues	960	960
Total new capital	$10,794	$10,794
Cumulative to date:		
1935	$4,105,000	1936	$10,794,000

Note: These figures include private bonds, and stocks sold for productive purposes; state and municipal bonds for construction; PWA loans and grants to states and municipalities, including the special highway funds; PWA private loans, and allotments for federal construction, deficiency act funds. An arbitrary percentage (25%) of the WPA allotments and local contributions to WPA work is included to allow for the capital additions through the Works Progress Administration division of the new program.

INDEX NUMBER

ENR Cost	1913 = 100	1926 = 100	ENR Volume	1913 = 100	1926 = 100
Jan., 1936	199.48	85.89	Dec., 1935	254	111
Dec., 1935	194.90	93.69	Nov., 1935	171	75
Jan., 1935	198.72	95.52	Dec. 1934	105	46
1935 (Av.)	195.22	93.84	1935 (Av.)	135	58
1934 (Av.)	198.10	95.23	1934 (Av.)	114	50
1933 (Av.)	170.18	81.80	1933 (Av.)	102	47



Current Construction Unit Prices

International Boundary Flood Control

THE International Boundary Commission opened bids Oct. 15, 1935, at El Paso, Texas, for the construction of Unit 3 of its flood control program. The present work, located in the city of Nogales, will consist of improving the channel of Nogales Wash, from the end of the completed first unit of the project approximately 3,100 ft. to a point near the northern city limit line. PWA minimum hourly wages of $1.00 for skilled and 40c. for common are specified with contract completion scheluled for 240 days after contract award.

The government furnishes f.o.b. Nogales siding, cement, admixtures and reinforcing steel. Alternate proposals were requested but none received for mortar rubble masonry construction of the channel and stilling basin. The unit prices and totals follow of the three low bidders on the project. (A) T. A. Allen Construction Co., Los Angeles, Cal., $75,634.40; (B) Hayner & Burn, Las Cruces, N. M., $80,244.50; (C) Chamberlain & Strain, San Antonio, Tex., $102,043.50.

FLOOD CONTROL, INTERNATIONAL BOUNDARY

	A	B	C
I. Reinforced Concrete Channel			
1. Clear and grub—total	$210.00	$600.00	$3,100.00
2. Channel excavation, common—14,000 cu.yd.	.38	.65	1.30
3. Channel excavation, rock—1,000 cu.yd.	1.25	1.50	2.50
4. Embankment—5,500 cu.yd.	.13	.40	1.25
5. Concrete, forms—1,075 cy.yd.	16.40	11.50	14.00
6. Concrete channel lining—2,745 cu.yd.	10.32	9.70	10.50
7. Reinforcing steel labor—204,000 lb.	.014	.02	.01
8. Expansion joints, ½ in.—3,600 sq.ft.	.28	.29	.30
9. Gravel drains—5,000 lin.ft.	.29	.25	.40
10. Galv. iron pipe, 16 ga. 18 in. corr.—85 lin.ft.	3.00	2.50	3.50
11. Raise present sewer manholes—1 lin.ft.	25.00	12.00	20.00
12. Lower present sewer manholes—1 each	25.00	20.00	15.00
II. Stilling basin			
13. Clear and grub—total	47.00	200.00	100.00
14. Channel excavation, common—8,000 cu.yd.	.305	.75	1.00
15. Channel excavation, rock—100 cu.yd.	1.45	1.50	2.00
16. Embankment—100 cu.yd.	.19	1.00	1.25
17. Concrete, forms—80 cu.yd.	18.40	11.50	13.00
18. Concrete, channel lining—650 cu.yd.	6.52	10.75	10.00
19. Reinforcing steel labor—37,000 lb.	.015	.015	.01
20. Expansion joints, ½ in.—950 sq.ft.	.30	.30	.40
21. Gravel drains—900 lin.ft.	.23	.25	.40
III. 18-in. Outfall Sewer Line—Sta. 0+00 to 10+55			
22. Vitrified clay sewer pipe, 18 in.—1,055 lin.ft.	3.80	3.50	3.00
23. Vitrified clay sewer pipe, 8 in.—100 lin.ft.	2.80	1.00	1.00
24. Vitrified clay sewer pipe, 4 in.—60 lin.ft.	2.25	.60	.50
25. Raise Manhole No. 5—4 lin.ft.	24.50	10.00	10.00
26. New Std. manholes—3 each	170.00	108.00	75.00
IV. 18-in. Outfall Sewer Line—Sta. 10+55 to 14+40			
27. Vitrified clay sewer pipe, 18 in.—385 lin.ft.	5.00	4.00	3.00
28. Vitrified clay sewer pipe, 4 in.—75 lin.ft.	2.20	.60	.50
29. New std. manholes—2 each	186.00	128.00	75.00
30. New shallow manholes—1 each	83.00	83.00	60.00
31. Manhole drop connections, 8 in.—1 each	27.00	25.00	6.00

Roads and Bridges, Colorado

TWO gravel surfacing projects and two small bridges have been selected as representative of several projects awarded in October and November by the Colorado State Highway Department. The contract unit prices and the average of all bids submitted on each of the four jobs are shown in the accompanying table. Chas. D. Vail is state highway engineer. Ten per cent added by the state for engineering and contingencies is included in the total figures.

Mesa County—Gravel surfacing, 4.1 miles on state highway No. 6 between Grand Junction and Whitewater: (A) J. B. Claybaugh, Grand Junction, Colo. (contract) $76,324; (B) Ave. of eight bids, $88,167.

Moffat County—Gravel surfacing, 4.87 miles between Maybell and Elk Springs on state highway No. 2: (C) H. I. Gardner, Glenwood Springs, Colo., (contract) $117,281; (D) Ave. of four bids, $123,830.

West Bijou Creek Bridge—Bridge over West Bijou Creek on state highway No. 102 near Strasburg: (E) Henry Shore, Grand Junction, Colo., (contract) $65,371; (F) Ave. of eleven bids, $74,397.

Bijou Creek Bridge—Bridge over Bijou Creek east of Wiggins on state highway No. 2: (G) Geo. W. Condon Co., Omaha, Nebr. (contract) $70,111; (H) Ave. of five bids, $79,429.

ROADS AND BRIDGES, COLORADO HIGHWAY SYSTEM

	Gravel Road Surfacing						Highway Bridges					
	Mesa County			Moffat County			West Bijou Creek Bridge					
Items	Quan.	A	B	Quan.	C	D	Items	Quan.	E	F		
Clear and grub—total		$400.00	$587.50		$2,000	$2,000	Clear and grub—total		$50.00	$117.73		
Remove structures—total	7	50.00	212.50	1	100.00	168.75	Remove bridge—total	1	50.00	181.36		
Remove fence—lin.ft.	4,100	.02	.02	2,100	.02	.0125	Asphalt plank—sq.ft.	27,600	.42	.46		
Excav. unclass—cu.yd.	107,000	.225	.21	175,000	.25	.26	Excav. common—cu.yd.	4,500	.32	.36		
Cut slope—mile	7.4	50.00	150.00	5	150.00	262.50	Untreated bridge timber—M.B.M.	17.7	80.00	78.18		
Dry rock excav. str.—cu.yd.	210	1.10	1.39	300	1.25	1.625	Treated bridge timber—M.B.M.	398.8	89.00	100.50		
Dry common excav. str.—cu.yd.	840	.80	.98	900	1.00	1.06	Dry common excav. str.—cu.yd.	40	.85	1.123		
Wet rock excav. str.—cu.yd.	90	1.50	2.26	100	2.00	2.12	Treated timber piles—lin.ft.	9,080	.95	1.178		
Wet common excav. str.—cu.yd.	360	1.50	2.47	300	1.25	2.25	Wet common excav. str.—cu.yd.	5	.95	2.72		
Sta. yd. overhaul—sta.yd.	622,000	.015	.016	460,000	.02	.02	Pile cut off treated—lin.ft.	100	.50	.50		
Yd. mile overhaul—yd.mi.	51,000	.12	.153	1,000	.20	.20	Dry rub. slope pave. 18 in.—sq.yd.	90	4.00	3.68		
Gravel surfacing—ton	51,000	.60	.743	23,400	.80	.79	Drain pipe—each	96	3.25	3.57		
Concrete, Cl. A—cu.yd.	82	18.00	21.75	706	20.00	22.00						
Concrete, Cl. B—cu.yd.	56	18.00	21.38	44	20.00	22.00	Bijou Creek Bridge					
Reinforcing steel—lb.	5,400	.06	.067	67,800	.055	.056	Items	Quan.	G	H		
Culvert, 4-in. C.I.—lin.ft.	104	.65	1.39				Remove bridge—total		$1,000	$3,200		
Culvert, 18-in. c.m.p.—lin.ft.	3,350	1.60	1.81	[a]192	1.00	1.25	Dry common excav. str.—cu.yd.	550	1.50	1.15		
Culvert, 24-in. c.m.p.—lin.ft.	72	2.50	2.61	1,294	2.50	2.18	Wet common excav. str.—cu.yd.	66	2.00	2.55		
Culvert, 36-in. c.m.p.—lin.ft.	514	4.90	4.71	[b]212	3.00	2.84	Untreated bridge timber—M.B.M.	0.36	100.00	102.00		
Culvert, 60-in. c.m.p.—lin.ft.	160	11.00	13.05				Treated bridge timber—M.B.M.	5.6	125.00	124.00		
Siphon, 18-in. c.m.p.—lin.ft.	474	2.30	2.42				Concrete, Class A—cu.yd.	607.4	20.00	22.30		
Guard fence, wire cable—lin.ft.	816	.65	.76	4,244	.60	.77	Reinforcing steel—lb.	91,115	.05	.051		
Barbed wire fence—lin.ft.	35,200	.07	.08	63,200	.065	.031	Structural steel—lb.	563,400	.05	.055		
Comb. wire fence—lin.ft.	6,000	.14	.15				Treated timber piles—lin.ft.	828	1.20	1.33		
Barbed wire gates—each	8	7.00	4.94	18	5.00	4.33	Treated pile cutoff—lin.ft.	10	.50	.50		
Driveway gates—each	4	10.00	14.94				Concrete piles—lin.ft.	27,000	4.70	5.50		
Project marker—each	1	25.00	25.63				Dry rub. slope pave. 18-in.—sq.yd.	494	4.00	3.55		
R.O.W. marker—each	31	4.00	4.56	57	3.00	4.13	Sheet copper—lb.	760	.45	.43		
Trash grd. 18-in. siphon—each	19	10.00	9.00				Drain pipe—each	36	4.00	3.50		

[a] 15-in. culvert. [b] 30-in. culvert.

BUSINESS SIDE OF CONSTRUCTION

Construction Highest Since 1931 December Public Awards Raise Total

ENGINEERING construction awards in December reached the highest monthly total since April, 1931. Heavy public works lettings are responsible for this record with state and municipal work predominating. The month's volume is $235,506,000, of which $28,413,000 is private and $207,093,000, public. Of the latter, $58,941,000 is federal and $148,152,000, state and municipal. Corresponding values last year are: total, $101,419,000; private, $23,907,000; public, $77,512,000; federal, $15,915,000; and state and municipal, $61,597,000. The gain over last December is: total, 132%; private, 22%; public, 167%, federal, 237%; and state and municipal, 124%.

The year's total is $1,590,151,000 compared with $1,360,596,000 last year. These totals are made up of private awards $371,139,000 compared with $241,263,000 last year; public, $1,219,012,000 compared with $1,037,600; federal, $359,004,000 compared with $278,166,000; and state and municipal, $860,008,000 compared with $759,434,000 a year ago.

Public building is largely responsible for the big increase in volume of awards for December together with earthwork, irrigation and waterways. The Guntersville Dam, started by TVA pushed up the total by $29,000,000. Highway awards were heavier than last year, but not up to last month. Industrial building was slightly higher than last month but commercial building dropped below.

Geographically, Middle Atlantic held its own high volume while all other territories show increases over last month and all territories show substantial gains over December last year. Gains for December were greatest in New England, South, Middle West and West of Mississippi territories.

New Capital

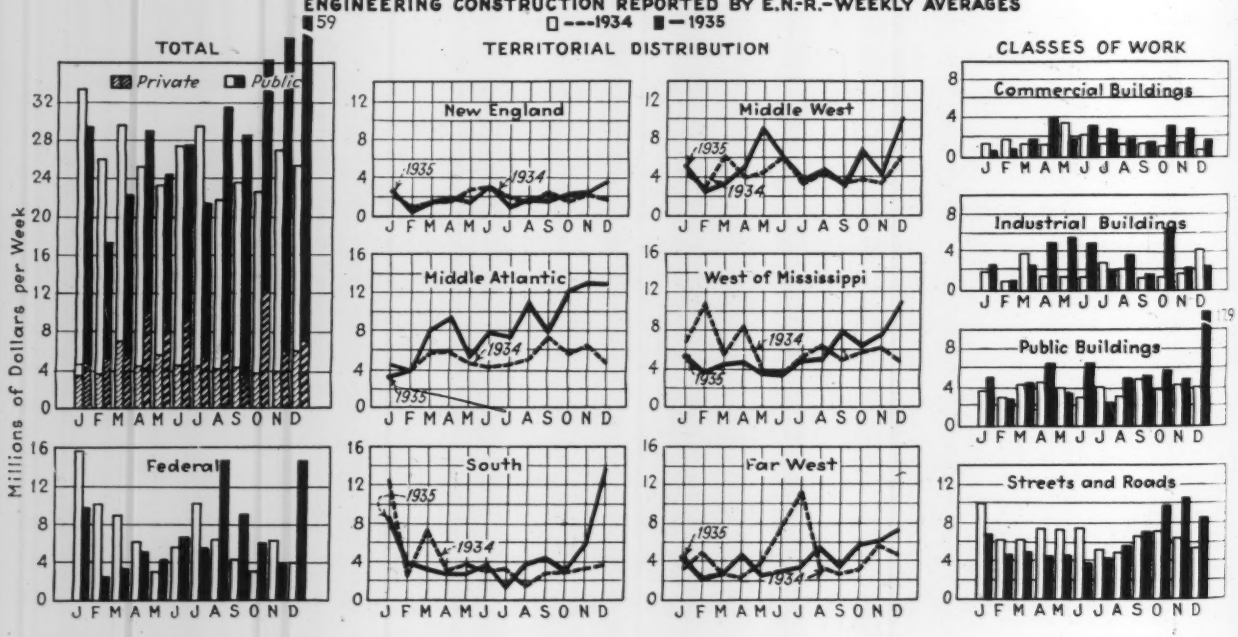
The new capital cumulative total at the end of the year was $2,738,034,000 compared with $1,282,000,000 a year ago. This means a substantial holdover of funds for commitment next year. Private investment financing increased from $407,000,000 in 1934 to $535,000,000 in 1935. The state and municipal bond market has remained good and cities are obtaining good prices for their bonds. The corporate security market was very active for refunding issues in 1935 but issues for new construction were relatively scarce. Indications are that new construction financing will be sought by more industrial companies next year.

ENGINEERING CONSTRUCTION CONTRACTS REPORTED IN DECEMBER, 1935

Four Weeks—Thousands of Dollars (000 Omitted)

	New England	Middle Atlantic	South	Middle West	West of Mississippi	Far West	United States December 1935	United States Twelve Months 1935	United States Twelve Months 1934	Canada
Public Works										
Waterworks	803	4,358	2,532	1,340	1,747	3,695	**14,475**	80,677	92,495	10
Sewerage	2,254	4,125	755	3,329	2,779	3,012	**16,254**	99,935	61,068	.....
Bridges, public	1,046	6,363	699	2,452	5,680	838	**17,078**	86,861	88,800	89
Earthwork and waterways	199	1,092	31,115	3,740	5,145	7,032	**48,323**	258,740	266,431	114
Streets and roads	1,730	6,006	5,917	4,936	9,282	5,191	**33,062**	325,263	345,066	.....
Buildings, public	7,609	19,837	9,211	14,307	13,179	7,454	**71,597**	297,858	204,185	169
Unclassified, public	1,126	2,499	34	240	1,058	1,347	**6,304**	69,678	61,288	.....
Total public	14,767	44,280	50,263	30,344	38,870	28,569	**207,093**	1,219,012	1,119,333	382
Federal gov't (included in above classifications)	916	5,487	33,313	6,691	4,642	7,892	**58,941**	363,015	360,166	.....
Private										
Bridges, private	.....	.....	25	.....	90	.....	**115**	11,072	10,044	.....
Buildings, industrial	364	2,406	3,814	1,312	441	565	**8,902**	172,467	105,192	40
Buildings, commercial	205	3,616	.....	887	422	.....	**5,130**	108,817	80,685	.....
Unclassified, private	50	822	1,314	7,882	3,750	448	**14,266**	78,783	45,342	.....
Total private	619	6,844	5,153	10,081	4,703	1,013	**28,413**	371,139	241,263	40
December, 1935 (4 weeks)	**15,386**	**51,124**	**55,416**	**40,425**	**43,573**	**29,582**	**235,506**	.....	.....	422
November, 1905 (4 weeks)	9,534	51,212	23,131	17,205	29,639	24,252	**154,973**	.....	.....	2,204
December, 1934 (4 weeks)	6,500	18,818	14,624	24,040	19,083	18,354	**101,419**	.....	.....	4,696
Twelve months, 1935	101,631	441,940	245,303	280,494	295,136	225,647	.....	1,590,151	.....	81,008
Twelve months, 1934	100,432	273,556	214,803	226,571	310,325	234,909	.....	.....	1,360,596	47,927

ENGINEERING CONSTRUCTION REPORTED BY E.N.-R.-WEEKLY AVERAGES

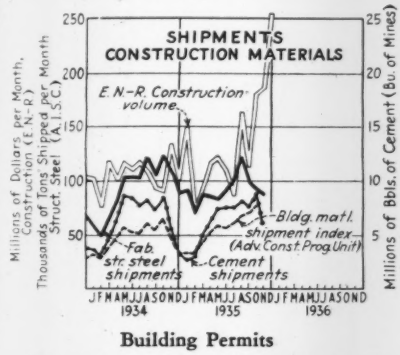


Materials

Cement—Cement shipments in November totaled 5,976,000 bbl., an increase of 5.3 per cent over last year. Production was increased 22.6 per cent according to report of the Bureau of Mines. Ratio of production to capacity was 32.2 compared with 26.2 last year and 33.1 last month.

Steel—The operating rate of steel companies having 98.0 per cent of the steel capacity reporting to American Iron and Steel Institute declined from 56.4 at the beginning of December to 49.5 for the last week. The 4-weeks averages compare as follows: average for December is 54.0 compared with 55.5 average of previous weeks, 53.1, average of previous month, and 32.8, average for December last year.

Lumber—Lumber production in the United States in 1935 climbed back from the depression low record of 10 billion feet in 1932 (about the same as in 1869) to approximately 17½ billion feet. This compares with 15½ billion feet in 1934, 14 billion feet in 1933, and a production of 37 billion feet in 1929, as reported by National Lumber Manufacturers Assn.


SHIPMENTS
CONSTRUCTION MATERIALS
E.N.-R. Construction volume
Bldg. matl. shipment index (Adv. Const. Prog. Unit)
Fab. str. steel shipments
Cement shipments
Millions of Dollars per Month, Construction (E.N.-R.)
Thousands of Tons Shipped per Month, Struct. Steel (A.I.S.C.)
Millions of Bbls. of Cement (Bu. of Mines)
J F M A M J J A S O N D J F M A M J J A S O N D J F M A M J J A S O N D
1934
1935
1936

Building Permits

Permits issued during November for the 215 cities regularly reporting to Dun and Bradstreet, Inc., were valued at $56,308,900, compared with $66,965,705 in October, and $27,459,066 in November, 1934. This represented a decrease of 15.9 per cent from October, or only slightly more than the usual seasonal decline of about 12.0 per cent. Despite this falling off, the volume of building contemplated last month was 105.1 per cent greater than in the corresponding month of last year, and was the highest November total since 1931.

Permits issued at the 214 cities outside of New York totaled $43,423,674 in November, a loss of 4.5 per cent from the preceding months' total of $45,490,760, but an increase of 100.5 per cent over the $21,665,041 figure set down in November a year ago.

The total value of permits reported by the Bureau of Labor Statistics during November was $78,193,000, a decrease of 11 per cent compared with the October valuation of $88,041,000. The decrease was chiefly accounted for by a sharp drop of 22.8 per cent in the value of permits issued for additions, alterations and repairs to existing structures. Residential permit valuation declined 11.7 per cent, while the value of permits issued for new non-residential construction came within 2.1 per cent of the October level.

In comparison with the corresponding month of last year, the value of building construction permits issued shows an increase of 89 per cent. The value of residential building permits was three times as great as in November, 1934.

During the first 11 months of 1935, permits were issued for buildings valued at more than $752,000,000. This is an increase of $300,000,000 or more than 66 per cent as compared with the corresponding period of 1934. Dwelling units were provided for 69,300 families, a gain of 155 per cent as compared with the same 11 months of 1934.

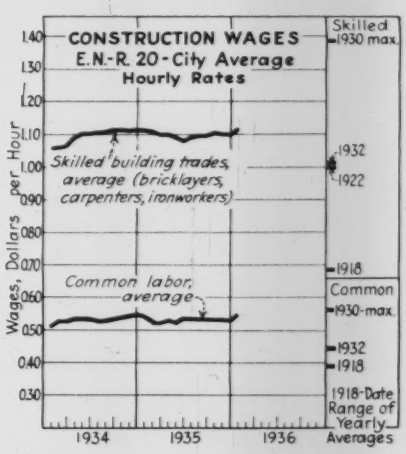
Labor

Employment in the production of six major construction materials as reported by Advance Construction Programs Unit Space Control, is 47.6 for November, 48.2 in October, 47.6 in September, 46.6 in August and 41.3 in November last year.

New York State reports that construction employment showed a sharp drop from October to November. The decrease was almost entirely seasonal and was a great deal sharper than that for the corresponding period a year ago. The severity of this year's October to November decrease was due in a large measure to the fact that employment, payrolls and hours held up in October instead of starting the usual downward movement.

Both employment and payrolls for all reporting firms dropped 13.4 per cent and hours dropped 14.5 per cent. Decreases were general for all kinds of contracting both in New York City and up-state New York. The greatest decrease was shown this month by highway contractors whose employment dropped 27 per cent. Miscellaneous general contractors showed a decrease of 14 per cent, general building contractors 11 per cent and subcontractors about 8 per cent.

WPA labor controversies continued in December. The Key West strike ended when unskilled workers were raised from $6.05 for 32 hours to $7.50 for 40 hours. Organized labor in Iowa has ordered a general WPA strike for Jan. 2, demanding



that the 120 hours allotted to each worker a month be reduced so that the hour rate will match that in private industry. They also want the monthly minimum of $40 now paid in rural counties increased to $55 a month and a general increase of 10 per cent for all those in the higher pay brackets where the maximum is now $85. There has already been an increase, averaging 25 per cent from changing classifications of State from district 2 rating to that of district 1. An effort is being made to settle the difficulty by conference prior to Jan. 2.

In upstate New York, 75 representatives of labor organizations voted on Dec. 21 to call a state-wide strike on all WPA projects employing skilled labor unless their demand for payment of the prevailing wage rate is met. An effort is being made to settle the controversy by conference before putting the strike action into effect.

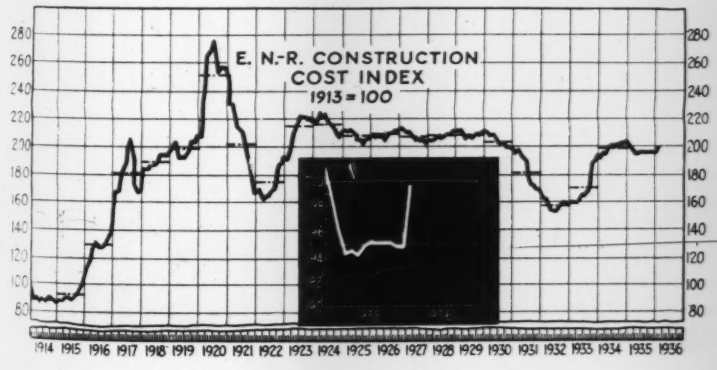
ENR Cost and Volume Index

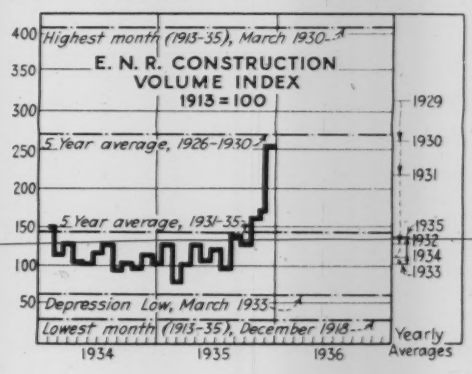
THE *Engineering News-Record* Construction Cost Index is 199.48 for January, a rise of 3.58 points due to increases in lumber price and 20-city common labor wage average.

The *ENR* Volume Index is 254 for December, the highest value since April, 1931.

INDEX NUMBER

ENR Cost	1913 = 100	1926 = 100	ENR Volume	1913 = 100	1926 = 100
Jan., 1936	**199.48**	**95.89**	**Dec., 1935**	**254**	**111**
Dec., 1935	194.90	93.69	Nov., 1935	171	75
Jan., 1935	198.72	95.52	Dec., 1934	105	46
1935 (Av.)	195.22	93.84	1935 (Av.)	135	58
1934 (Av.)	198.10	95.23	1934 (Av.)	114	50
1933 (Av.)	170.18	81.80	1933 (Av.)	102	47





CURRENT PRICES OF CONSTRUCTION MATERIALS

CEMENT, AGGREGATES AND READY-MIXED CONCRETE—F.O.B. CITY

	PORTLAND CEMENT — Per bbl., carload lots, including 40c. per bbl. for bags, cash discount not included			SAND AND GRAVEL — Per ton, carload lots			CRUSHED STONE Per ton, carload lots		CRUSHED SLAG Per ton, carload lots, f.o.b. plant		CONCRETE Ready Mixed 1:2:4, 50c.y. or more, delivered
	Cloth Bags*	Paper Bags	Bulk	Gravel, 1½ in.	Gravel, ¾ in.	Sand	1½ in.	¾ in.	1½ in.	¾ in.	
Atlanta	$2.89	$2.64	$2.44	$2.31	$2.31	$1.64	$1.69	$1.92	$1.80	$1.80	$8.50
Baltimore	2.69	2.44	2.24	1.80‡	1.80‡	1.30‡	1.80‡	1.80‡	1.80	1.80	7.35
Birmingham	2.40	2.15	1.95	1.80	1.80	1.45	1.00	1.00	.90	1.15	5.45
Boston	2.42	2.17	1.92	1.40	1.40	.90	1.40	1.40	.....	.....	6.50
Chicago	2.75	2.50	2.40	1.57	1.44	1.88	1.88	1.88	.....	.....	.....
Cincinnati	2.50	2.25	2.05	1.20	1.20	1.30	1.80	1.80	.....	.....	6.70
Cleveland	2.26	2.01	.....	1.40	1.40	1.30	1.60	1.60	1.75	1.75	7.05
Dallas	2.45	2.20	2.00	1.55	1.55	1.30	2.10	2.25	.....	.....	7.00
Denver	3.09	2.84	.....	1.20	1.40	.90	.....	.....	.....	.....	.....
Detroit	2.26	2.01	1.81	1.30	1.30	1.20	1.40	1.60	1.40‡	1.50‡	6.75
Kansas City	2.51	2.26	2.06	.....	1.85	1.25	1.85	1.80	.....	.....	7.65
Los Angeles	2.25	2.05	.....	1.40	1.40	1.00	1.40	1.40	.....	.....	6.70‡
Minneapolis	2.90	.....	2.45	1.00[p]	1.00[p]	.25[p]	1.00[p]	1.00[p]	.....	.....	6.50
Montreal	.....	1.70	.....	.85	.90	1.25	.85[p]	1.20[p]	.....	.....	4.50[r]
New Orleans	2.47	2.22	2.00	1.75	1.75	1.45	.....	.....	.....	.....	8.25
New York	2.60‡	2.35‡	.....	1.40†[x]	1.40†[x]	.75†[x]	1.75†[x]	1.85†[x]	.....	.....	8.00
Philadelphia	2.63	2.38	2.18	1.35‡	1.45‡	1.05‡	2.60‡	2.75‡	1.00‡	1.00‡	7.75
Pittsburgh	2.46	2.21	1.61	1.50‡	1.50‡	1.70‡	2.25‡	2.25‡	1.50	1.50	7.00
St. Louis	2.53	2.28	.....	1.40‡	1.40‡	1.40‡	.75[p]	.75[p]	.65/.95§	.50/.95§	6.65
San Francisco	2.72	2.52	2.20	1.35	1.35	1.35	1.50	1.50	.....	.....	7.53
Seattle	3.09	2.84	.....	1.00	1.00	1.00	1.44	1.44	.....	.....	7.56

*10c. allowed for each returnable bag. †Per cu. yd. ‡Delivered. §F.o.b. Granite City, Ill. [x]Barge lots alongside dock. [p]f.o.b. plant. [r]5 tons or more. [s]Within 3-mi. from Pub. Square. Subject to change without notice. [t]ton.

CURRENT MAXIMUM PRICES RECEIVED AT CEMENT MILL

Charge for bags not included. For cloth bags, add 40c. per bbl.; 10c. refund allowed for each returnable bag; for paper bags add 15c. per bbl., not refundable.

	Bagged	Bulk		Bagged	Bulk		Bagged	Bulk
Alpena, Mich	$1.50	$1.45	Ironton, Ohio	$1.50	$1.45	North Birmingham, Ala	$1.75	$1.70
Buffington, Ind	1.70	1.65	Iola, Kans	1.70	1.65	Richard City, Tenn	1.85	1.80
Crestmore, Calif	1.72	....	La Salle, Ill	1.70	1.65	Saginaw, Mich	1.50	1.45
Dallas, Tex. (Inc. 5c. tax)	1.80	1.75	Limedale, Ind	1.70	1.65	Steelton, Minn	1.80	1.75
Hannibal, Mo	1.70	1.65	Mason City, Ia	1.70	1.65	Universal, Pa	1.65	1.60
Hudson, N. Y	1.75	1.70	Norfolk, Va	1.76	1.71	Waco, Tex. (Inc. 5c. Tax)	1.80	1.75
Independence, Kans	1.70	1.65	Northampton, Pa	1.65	1.60	Wyandotte, Mich	1.45	1.40

Cash Discounts, Cement, to Contractors: truck delivery, 2% for cash on 10th of month; on carload deliveries, no trucking, same as dealer cash discount, 10c. per bbl. for payment within 15 days of date of invoice.

STRUCTURAL CLAY BUILDING TILE, BRICK AND LIME—DELIVERED

	STRUCTURAL CLAY TILE — PARTITION—SCORED — Per M. lots of 2,000 pieces or over, 3x12x12 in.	4x12x12 in.	8x12x12 in.	STRUCTURAL CLAY TILE — LOAD BEARING—SCORED — Per M. lots of 2,000 pieces or over, 8x12x12 in.	10x12x12 in.	12x12x12 in.	BRICK — Per M., in quantity, Common backing	Straight hard	LIME — Per ton, Hydrated finishing	in paper, Common hydrated	carload lot, Pulverized or lump
Atlanta	$75.80	$80.80	$151.60	$181.90	$212.20	$242.50	$14.25	$14.25	$24.00	$17.00	$15.90
Baltimore	91.00	98.00	183.00	219.00	315.00	390.00	13.00	17.00	17.00	12.50	19.25
Birmingham	78.75	84.00	157.50	189.00	201.25	242.00	15.00	19.00	2.50§	1.50§	2.00§[e]
Boston	84.40[s,t]	90.00[s,t]	168.75[s,t]	191.25[s,t]	246.75[s,t]	282.00[s]	14.50	18.00	20.00	15.50	3.50[g,d]
Chicago	66.00	70.40	132.00	168.65	196.75	224.85	10.20	11.20	18.00	13.40	14.00
Cincinnati	55.00	58.70	110.00	124.10	164.20	187.70	17.50	17.50	15.97	12.48	.....
Cleveland	45.00	48.00	90.00	108.00	138.50	158.50	13.00	13.00	16.00k	14.00k	2.65k[p]
Dallas	72.00	75.00	197.00	177.00	217.00	269.00	13.50	26.00	21.20	14.50	1.70[p]
Denver	78.50	88.00	141.50	166.50	196.00	225.00	10.50	15.00	30.00	22.00	22.50
Detroit	71.85	76.65	143.70	230.00	280.00	325.00	11.50	12.50	14.25	11.90	22.20
Kansas City	72.50	75.50	92.00*	140.50	177.75	207.25	15.00	24.00	18.00	11.89	14.20*
Los Angeles	77.50	94.25	134.00*	188.00	232.50	311.50	11.50	14.00	18.70	.....	19.70
Minneapolis	80.15x	85.50x	145.40x	167.75x	175.25x	243.70x	13.10	15.10x	25.50	21.00	23.00
Montreal	79.10x	90.40	169.50x	.....	212.40	136.60	20.75	31.00	15.00	10.00	7.00
New Orleans	61.50	65.10	123.20	157.00	195.00	.....	13.75	.....	16.75	13.00	.....
New York	84.00	90.00	135.00*	193.30†	238.80†	295.60†	10.00	.....	20.00	15.50	20.00
Philadelphia	76.00	80.00	150.00	172.00	240.00	295.00	18.00	20.00	16.35	11.25	10.75
Pittsburgh	58.40c	62.30c	116.85c	165.00c	217.00c	250.00c	15.00	22.00	17.20	14.50	2.22[p]
St. Louis	62.00	65.00	120.00	180.00	234.00	280.00	15.00	18.00	.55‡	.40‡	2.30[p]
San Francisco	84.00	94.50	225.00	.....	.....	.....	15.00	18.00	22.50	21.50	2.05[p]
Seattle	86.00	94.50	210.00	198.00	.....	.....	15.00[d]	18.50	30.00	26.00	3.00[p]

*6x12x12 in. †F.o.b. Perth Amboy, N. J. ‡Per sack. §Per bbl., 200 lbs. [p]Per bbl. 180 lbs. [g]per bbl. 280-lb. kLCL. [d]less $1 cash 15 days. [e]lump. [s]Smooth. xSelected common. [t]Carload lots delivered to job.

ROAD SURFACING MATERIALS—F.O.B. CITY

	PAVING BRICK AND BLOCKS — Granite per M., lots of 50,000, 4x4x8 in.	Brick per M., 3x4x8½ in., carload lots	Wood per sq. yd., 3½ in., 16-lb. treat.	PAVING ASPHALT — Per ton, less than 80 penetration, Tank car	Drums	ASPHALT BINDERS—FLUXES — Per gal., 80-300 penetration, Tank car	Drums	CUTBACK ASPHALT — Per ton, Tank car	Drums	ROAD OILS — Per gal., Tank car	ASPHALT EMULSION — Per gal., Tank car	Drum
Atlanta	$ 75.00	$35.00	$2.25	$18.20[z]	$23.41[z]	$0.728[z]	$0.999[z]	$19.20[z]	$27.22[z]	$0.668[z]	$0.085	$0.085
Baltimore	110.00	44.00	2.50	17.00	22.00	.075	.10	.09†	.125†	.....	.....	.....
Birmingham	110.00	25.00	....	19.00	24.00	.0878	.1128	.10†	.137†	.....	.06	.....
Boston	75.00	28.00	2.50	17.00	22.00	.07	.095	.09†	.12†	.07	.095	.125
Chicago	125.00	42.00	2.60	.....	.....	.....	.....	.....	.....	.....	.....	.....
Cincinnati	115.00	37.00	....	18.00	22.00	.09	.....	18.50	.....	.07	.08	.....
Cleveland	100.00‡	32.75	2.85	19.00	23.25	.075	.085	.075†	.0425†	.06	.085	.10
Dallas	.....	30.00	....	16.10	21.10	.0525	.10	15.65	23.15	.055	.107	.1438
Detroit	.....	37.00	....	19.67[x]	24.87[x]	.....	.....	17.00	22.50	.055	.11	.15
Kansas City	.....	45.00	....	18.50	23.50	17.59#	22.50#	.077†	.107†	.057	.11	.15
Los Angeles	.....	50.00	....	10.34	14.50	10.34#	14.50#	10.34	.....	.042	.06	.12
Minneapolis	.....	.....	2.50	18.20	24.70	.098	.098	21.85	34.65	.048	.....	.....
Montreal	70.00	60.00	3.62	14.00	19.66	.07	.093	19.00	26.50	.07	.135	.165
New Orleans	100.00	32.00	....	16.00	21.00	.075	.10	.09†	.125†	.....	.0785	.11
New York	130.00§	65.00	2.64	17.00	22.00	.075	.10	.09†	.125†	.....	.075	.11
Philadelphia	110.00	45.00	2.25	13.50	18.00	.05	.08	.05†	.08†	.045	.08	.....
Pittsburgh	115.00	40.00	....	19.00	24.00	.0775	.1125	.086†	.121†	.0675	.....	.....
St. Louis	40/115.00	35.00	....	18.50	23.50	.0775	.1075	.875†	11.75†	.04	.09	.125
San Francisco	.....	50.00	....	12.00	18.00	12.00#	18.00#	12.50#	23.00#	.04	.0575	.117
Seattle	.....	55.00	....	25.50	25.50	17.00#	23.00#	15.00	.....	.03	.19	.20

Note: Paving asphalt, tank car or boat, f.o.b. Maurer, N. J., per ton, Bermudez, $25.00; Trinidad, $21.00. *Per sq. yd. †Per gallon. ‡4½x6x5½in. #Per ton §4x5x9-in. Av. [x]Mexican. [z]Local reduction due to 20% reduction intra-state class freight rates, only Georgia affected.

CURRENT PRICES OF CONSTRUCTION MATERIALS

IRON AND STEEL PRODUCTS—BASE MILL PRICES

	STRUCT. SHAPES—PLATE	REINF. BARS ¼-in. billet,	RIVETS ½-in. structural	WIRE NAILS Base	SHEET PILING Base	STEEL RAILS Per Gross Ton			TRACK SUPPLIES			
						Standard	Light	Re-rolled	Angle bars	Std. spikes	Tie plates	Track bolts
Birmingham	$1.95	$2.10	$3.00	$2.55	....	$36.375	$34.375	$35.00	$2.55	$2.60	$1.90	$3.60
Chicago	1.85	2.10	3.00	....	$2.25	36.375	35.00	34.00	2.55	2.60	1.90	3.60
Pittsburgh	1.80	2.05	2.90	2.40	2.15	36.375	35.00	34.00	2.55	2.60	1.90	3.60

IRON AND STEEL PRODUCTS—F.O.B. WAREHOUSE, PER 100 LB., BASE PRICE

F.O.B. WAREHOUSE	STRUCTURAL SHAPES Per 100 lb., base price	REINFORCING BARS Per 100 lb., ¼ in., base price		EXPANDED METAL LATH —Per 100 sq.yd., carload lots—		WELDED FABRIC REINFORCING —Per 100 s.f., carload lots—		6x6 in., No. 6 & 6 wires Per sq.yd.	SHEET PILING Per 100 lb. base price
		New billet	Rail steel	Std. diamond mesh, 3.4 lb.	Std. ribbed 3.4 lb.	4x16 in., No. 5 & 10 wires	4x12 in., No. 8 & 12 wires		
Atlanta	$3.36	$2.34	$2.19	$21.00	$23.00	$1.53	$1.16	$0.1449	$2.70
Baltimore	3.00	2.75	2.60	25.00	28.00	1.41	1.08	.1332	2.90
Boston	3.54	2.923	1.925	20.00†	22.00†	1.46	1.12	.1449	2.60
Chicago	3.20	2.10	1.95	22.00	24.00	1.40	1.08	.1323	2.25
Cincinnati	3.40	3.25	3.25	25.01	29.50	1.39	1.07	.1287	....
Cleveland	3.31	2.75	2.60	20.00	22.00	1.37	1.06	.1287	....
Dallas	3.25	2.80	2.65	22.00	25.00	1.63	1.23	.1548	2.985
Denver	3.95	3.76	3.61	22.00	25.00	1.68	1.26	.1584	....
Detroit	3.42	2.20	2.05	20.00†	22.00†	1.41	1.08	.1323	2.43
Kansas City	3.75	2.75	2.60	18.45	21.35	1.50	1.14	.1422	2.69
Los Angeles	3.00	2.525	....	23.00	27.50	1.68	1.26	.1584	2.65
Minneapolis	3.45	2.86	2.71	22.00	26.00	1.51	1.15	.1431	2.57§
Montreal	3.15	2.40	2.30	25.50	28.75	2.30	1.71	.238	2.80
New Orleans	....	....	....	19.00	23.00	1.54	1.17	.1458	....
New York	3.37	2.50	2.35	18.50	20.50	1.43	1.10	.1350	2.50
Philadelphia	2.98	3.06	2.22	20.00	24.00	1.42	1.09	.1332	2.46
Pittsburgh	1.80‡	1.80‡	1.70‡	20.00‡	22.00‡	1.34	1.04	.1260	2.15
St. Louis	3.45	3.00	2.85	22.00	24.00	1.42	1.09	.1341	2.30
San Francisco	3.50	2.475	2.325	23.00	28.00	1.68	1.26	.1584	2.60
Seattle	3.55	2.50	....	30.00	33.00	1.68	1.26	.1584	2.60

‡Base Mill Price. Note: Shapes, bars and piling subject to quantity discounts. §Mill Price plus freight to Minneapolis. †f.o.b. delivered.

PAINTING AND ROOFING SUPPLIES—F.O.B.

	RED LEAD Per 100 lb. in 500-lb. lots	WHITE LEAD Per 100 lb. in 500-lb. lots#	READY-MIXED PAINT Per gal., drums			ROOFING SUPPLIES Carload lots, f.o.b. factory				
	Dry	in oil	Graphite*	Aluminum†	Ferric Oxide‡	Rolls, slate surfaced, 85-90 lb., per sq.	Asphalt felt, per 100 lb.	Tar felt, per 100 lb.	Asphalt coating, per gal.	Tar pitch, 350--lb. bbl., per ton
Atlanta	$7.75	$10.50	$1.60	$3.10	....	$1.69	$1.97	$2.90	$.36	$25.40
Baltimore	7.00	10.00	1.40	2.25	$1.90	2.35	2.55	2.55	.48	25.00
Birmingham	7.25	10.50	2.35	2.35	1.85	1.68	1.63	1.69	.36	21.88
Boston	7.00	10.00	1.75	2.60	.04½x	1.80	3.25	3.25	.42	22.00
Chicago	7.00	10.00	1.85	2.45	1.30	1.55	2.50	2.50	.38	22.00
Cincinnati	7.00	10.00	1.45	2.50	1.40	2.40	2.39x	2.39x	.36	21.00
Cleveland	7.00	10.00	1.65	2.30	1.40	1.60	1.79	1.79x	.24	20.00
Dallas	7.25	11.00	1.80	2.24	....	2.40x	4.17	4.17	.15	35.00
Denver	7.50	10.75	2.55	....	....	2.25	3.55	3.55	.35	30.00
Detroit	7.00	10.00	1.65	2.30	1.40	2.55	2.80	2.55	.35	30.00
Kansas City	7.00	10.12½	1.25	2.65	1.00	2.05	3.10–3.20	3.10–3.20	.23	24.50
Los Angeles	7.25	10.25	1.60	2.25	2.30	2.00	1.50	....	.45	....
Minneapolis	7.00	10.12½	....	....	....	1.55	1.63x	1.63x	.29	23.30
Montreal	....	8.20	1.85	3.50	1.85	1.90	2.44	1.88	1.40§	1.52§
New York	7.00	10.00	1.70	2.25	1.50	1.55	1.63x	1.63x	.232	22.00
Philadelphia	7.00	10.00	2.50	2.95	1.50	1.68	1.86x	1.48x	.37	22.00
Pittsburgh	7.00	10.00	1.05	1.95	.80	1.75	1.65x	1.65	.38	25.00
St. Louis	10.00	10.00	1.85	2.45	1.30	1.76x	3.00	3.00	.26	25.00
San Francisco	7.25	10.25	1.80	2.75	1.10–2.00	1.89	3.10	3.10	.38	26.00
Seattle	7.25	10.25	1.80	2.85	2.20	3.30	2.66	2.60	.60	30.00

*U. S. War Dept. Spec. 3-49A. †ASTM Spec. D266-31. ‡80% maximum ferric oxide. §Per 100 lb. xPer roll, 65 lb. xPer lb.
Note: Red lead in oil 50c higher than white lead in oil. #Basis of quoting changed this month from list to 500-lb. lots.

MISCELLANEOUS ITEMS

	WINDOW GLASS Discounts from latest jobbers List, Sept. 15, 1928 Single or Double Thickness		EXPLOSIVES Per lb. dynamite delivered 50-lb. cases Gelatin	
	A quality	B quality	40%	60%
Atlanta	85%	85%	$0.155	$0.17
Baltimore	88%	90%	.16	.175
Birmingham	88%	90%	.105	.120
Boston	88–10–5%	90–10–5%	.155	.17
Chicago	87%	89%	....	....
Cincinnati	89–10%	91–10%	.27	.29
Cleveland	85–10%	85–10%	.19	.205
Dallas	87%	89%	.17	.185
Denver	86%	88%	.155	.17
Detroit	87–10%	89–10%	.225	.240
Kansas City	86–10%	88–10%	.16	.175
Los Angeles	90%*	90–40%	.1725†	.1925†
Minneapolis	86%	88%	.175	.19
Montreal	60–30%	70–5%	.1875	.2125
New Orleans	88%	90%	.19	.22
New York	88%	90%	.225	.24
Philadelphia	88%	90%	.1550	.17
Pittsburgh	88%	88%	.11	.1250
St. Louis	89%	89%	.11	.125
San Francisco	82%	87%	.1575	.1775
Seattle	90–10%	90–20%	.1425	.1575

*Disc. from list Aug. 1, 1929. †F.o.b. Arsenal. ‡Double thickness A & B.

CHEMICALS

Water, sewage treatment, road work, f.o.b. carlots, New York.	
Bleaching powder, in drums, F.o.b. works, per 100 lb.	$2.00 @ $2.25
Calcium chloride, 77-80%, flaked, in 400-lb. drums or 100-lb. moisture proof bags, f.o.b. works, freight equalized with points of competition, per ton	22.00 @ 35.00
Chlorine cylinders, per lb. delivered	.055
Silicate of soda, 52 deg., in drums, f.o.b. works, per 100 lb.	1.35
Soda ash, 58%, in paper bags, per 100 lb.	1.25
Sulphate of aluminum, commercial, in 100 lb. bags per ton	27.00
Sulphate of copper, in bbl., per 100 lb.	3.85

PILES

Prices per linear foot, pine, with bark on, f.o.b. New York; delivered from barge, 1½ to 2c. per ft. additional:

Dimensions	Points	Length	Short Leaf Barge	Short Leaf Rail	Long Leaf Barge	Long Leaf Rail
12 in. at butt	6 in.	30 to 50 ft.	$0.12	$0.165	$0.13	$0.16
12 in.—2 ft. from butt	6 in.	50 to 59 ft.	.16	.21	.15	.20
12 in.—2 ft. from butt	6 in.	60 to 69 ft.	.17	.225	.16	.21½
14 in.—2 ft. from butt	6 in.	50 to 69 ft.	.195	.235	.20½	.24½
14 in.—2 ft. from butt	6 in.	70 to 79 ft.	.2125	.245	.24½	.30½
14 in.—2 ft. from butt	5 in.	80 to 85 ft.	.275	.385	....	....
14 in.—2 ft. from butt	5 in.	85 to 89 ft.	.315	.452	....	....

RAILWAY TIES

Prices f.o.b., per tie, for carload lots:		6 In. x 8 In. by 8 Ft.	7 In. x 9 In. by 8½ Ft.
Boston	Oak, untreated	$1.25	$1.80
	Pine, untreated	1.35	1.85
	Pine, creosoted	1.75	2.45
New York	Long-leaf sap pine, untreated	.80	1.00
	Mixed oak, untreated	....	1.00
	White oak, untreated	.75	1.50
Birmingham	White oak, creosoted	no market	
	Southern pine, untreated *6x8x8'6'	.45*	.60
	Southern pine, creosoted	1.00*	1.20
Chicago	White oak, untreated	1.15	1.40
	Oak, empty cell, creosoted	1.50	1.88
	Oak, zinc treated	1.40	1.70
	Southern pine, creosoted	1.35	1.78
Los Angeles	Fir, untreated	.50	.72
	Fir, creosoted	1.67	2.40
Philadelphia	Red oak, untreated	1.00	....
	Red oak, creosoted	....	2.10
St. Louis	White oak, untreated	1.03	1.35
	Red oak, untreated	1.00	1.30
	Red oak, creosoted	1.45	1.90
San Francisco	Sap Pine or cypress, untreated	.90	1.25
	Douglas fir, green, untreated	.45	.63
	Douglas fir, empty cell, creosoted	1.14	1.56
Montreal	Birch or maple, untreated	1.00	1.10
	Birch or maple, creosoted	1.25	1.55

CURRENT PRICES OF CONSTRUCTION MATERIALS

WATER, SEWER AND DRAIN PIPE

	C. I. PIPE	VITRIFIED SEWER PIPE				CLAY DRAIN TILE		CONCRETE SEWER PIPE		WROUGHT STEEL PIPE			
	Per net ton, f.o.b. 6 in. to 24 in.*	Per foot, delivered, standard (‡ f.o.b.) 8 in., s.s.	12 in., s.s.	24 in., d.s.	36 in., d.s.	Per 1,000 ft., carload lots, f.o.b. 6 in.	8 in.	Per ft., delivered; ASTM C 14-24 12 in.	24 in.	Full standard weight. # 1 to 3 in., Butt Weld Black	Galv	3½ to 6 in., Lap Weld Black	Galv.
Atlanta	$43.00	$0.225	$0.405	$1.4625	$3.25	$80.00	$128.00	$0.50	$1.625	44%	37%	42%	34%
Baltimore	46.50	.25	.50	2.10	5.75	108.00	168.50	.75	2.00				
Birmingham	39.00	.25	.45	1.625	4.66	85.00	220.00	.45	1.60	64%	55%	65%	56%
Boston	46.50	.182	.351	1.62	5.0225	102.60	153.00	.378	2.15				
Chicago	47.50	.31	.61	2.25	6.25	100.00	150.00	.675	2.25	56%	45%	55%	46%
Cincinnati	46.00	.185	.351	1.485	5.125	69.00	108.00	.40	1.40	53.04%	42.02%	54.265%	43.245%
Cleveland	47.50	.161	.3105	1.305	4.305	42.50	88.50	.35	1.74	58.4%	48.4%	60.6%	49.6
Dallas	51.00	.25	.45	1.80	.....	160.00	250.00	.41	1.41	64%	53%	64%	56
Denver	59.00	.27‡	.47‡	1.98‡	.....	105.00	180.00	.....	.....	56%	45%	43%[b]	57%
Detroit	47.50	.245	.4725	2.025	5.74	82.00	136.00	.35	1.20	49%	38%	50%	39
Kansas City	49.00	.32	.57	2.27	4.90	120.00	140.00	.40	1.50	49%	38%	50%	39
Los Angeles	47.50	.2825‡	.508‡	2.03‡	5.535‡	115.50	192.50	1.00	2.00	53.57%	43%	53%	42.51
Minneapolis	49.50	.255	.459	1.836	4.67	.....	.....	.50	1.34	....	....	....	....
Montreal	50.00	.80	1.50	6.00	.....	45.00	75.00	.45	.....	....	....	....	....
New Orleans	45.00	.32	.51	1.65	.....	67.00	.....	.45	2.00				
New York	46.00	.29	.57	2.25	6.35	.....	.....	.55	2.00	51.88%[a]	40.86%[a]	53.10%[a]	42.08%[a]
Philadelphia	43.00	.336	.648	2.835	8.68	175.00	210.00	.54	1.80	52.37%[a]	41.35%[a]	53.39%[a]	42.57%[a]
Pittsburgh	49.00	.175‡	.3375‡	1.44‡	4.81‡	69.00	108.00	.75c	1.75	64%	55%	65%	56%
St. Louis	46.00	.255	.459	1.836	3.96	85.00	170.00	.80	2.00	51.266%	40.245%	52.49%	41.47%
San Francisco	47.00	.265	.477	1.908	5.22	103.50	172.50	.45	2.20	52.4%	63.4%	51.1%	64.6%
Seattle	48.50	.35†	.63†	2.52†	6.30†	96.00	200.00†	.50†	1.80	65.80%	57.25%	66.75%	56.30%

*b. & s. class B and heavier, C/L lots, 200 tons and over. Burlington, N. J. (base) $43.00. Gas pipe and class A, $3 per ton additional. 4-in., $3 per ton additional. 30 in. and larger usually $2 per ton less. ‡Price at factory. †Less 30% in C/L Lots.

#Discounts from standard list for delivery from warehouse, except Pittsburgh prices are f.o.b. mill. Base price $200 per net ton. List prices per ft.: ¼ in., 8¢; ⅜ in. 11½c.; 1 in. 17c.; 2 in., 37c.; 2½ in., 58½c.; 3 in., 76½c.; 4 in., $1.09; 6 in., $1.92.

[a]2½ to 3 in. [b]Resale price to consumer, car load lots shipped from mill.

c Concrete Culvert pipe reinforced.

LUMBER AND TIMBER—PER M FT. B.M., CARLOAD LOTS F.O.B.

		SHORT LEAF YELLOW PINE AND DOUGLAS FIR — All S. L. Y. P. is No. 2 common or better and for No. 1 N. C. Box. All Fir planks No. 2 common; Fir timber is No. 1 common. Lengths up to 20 ft.								LONG LEAF Y. P. Merchantable grade up to 20 ft.	
		1x6,[s]	1x8,[s]	2x4,[s]	2x6,[s]	2x8,[s]	2x10,[s]	3x12,[R]	6x12,[R]	12x12,[R]	2x12,[R]	12x12.[R]
Atlanta	Southern Pine	$15.00	$15.00	$17.00	$17.00	$17.00	$19.00	$25.00	.....	.....	$38.50	$40.00
Baltimore	Southern Pine	23.00	24.00	29.50	28.50	29.00	30.50	37.50	.....	.....	54.00	55.00
	Douglas Fir	29.00	29.00	31.00	29.00	30.00	30.50	32.00	$33.00	$34.00		
Birmingham	Long Leaf	18.00	18.25	18.25	16.25	17.25	17.25	39.00	.....	.....	34.00	36.80
	Southern Pine	18.00	18.25	17.00	15.00	16.00	16.00	26.00	26.00	41.75	.....	.....
Boston	Southern Pine	27.00	27.00	32.00†	33.00†	47.00†	55.00†	70.00†	.....	.....	70.00	53.00
	Douglas Fir	27.00	27.00	30.00	33.00	35.00	35.00	40.00	41.00	41.00		
Chicago	Southern Pine	28.00	28.00	32.00	31.00	31.00	34.00	44.00	.....	.....	53.00	57.00
	Douglas Fir	33.00	34.00	38.00	36.00	37.00	38.00	40.00	40.00	40.00	.....	.....
Cincinnati	Southern Pine	23.00	25.00	26.00	25.00	25.50	26.50	40.00	.....	.....	31.50	.....
	Douglas Fir	.....	.....	.....	.....	.....	.....	43.50	46.25	46.25	.....	.....
Cleveland	Southern Pine	28.00	30.00	36.00	30.00	34.00	36.00	47.00	45.00	.....	50.00	62.00§
Dallas	Southern Pine	d28.35	30.60	31.50	29.80	30.15	30.15	50.40	.....	.....	42.75	67.95
Denver	Douglas Fir	41.00	41.00*=	42.00*	42.00*	42.00*	46.00*	52.00*	56.00*	61.50	.....	.....
Detroit	Southern Pine	24.00	24.00	25.00	24.50	24.50	25.50	35.00	.....	.....	29.00	41.50
	Douglas Fir	.....	.....	.....	.....	.....	.....	41.50	41.50	41.50	.....	.....
Kansas City	Southern Pine	23.50	24.00	23.50	23.00	23.50	24.50	34.00	.....	.....	53.00	60.00
	Douglas Fir	27.50	28.50	29.00	27.50	27.50	30.00	33.00	35.00	35.00	.....	.....
Los Angeles	Douglas Fir	30.00,	30.00,	30.00,	30.00,	30.00,	30.00,	35.00,	43.00y	39.00y	.....	.....
Minneapolis c	Western Pine	45.00*	51.50*	50.00*	41.00*	41.00*	42.00*	59.50*[k]	.....	.....	58.00*[k]	.....
	Douglas Fir	39.00*	42.00*	43.50*	41.00*	41.00*	42.00*	59.50*	59.50*	59.50*	.....	.....
Montreal	Spruce	28.00	29.00	25.00	27.00	30.50	33.00	36.00	.....	.....	.....	.....
	Douglas Fir	47.50	53.00	42.50	44.00	44.00	45.75	51.00	51.00	51.00	43.00	.....
New Orleans	Southern Pine	23.50	25.50	28.00	25.00	27.00	25.50	38.00	.....	.....	44.00	54.00
	Douglas Fir	28.50	30.00	33.00	29.00	32.00	33.50	37.00	.....	.....	.....	.....
New York	Southern Pine	33.00*	34.00*	33.00*	34.00*	34.00*	38.00*	45.00*	.....	.....	70.00*	70.00*
	Douglas Fir	.....	.....	37.00*	37.00*	35.00*	38.00*	40.00*	43.00*	43.00*	.....	.....
Philadelphia	Southern Pine	30.00	31.00	32.00	32.00	33.00	34.00	36.00	.....	.....	36.00	42.00
	Douglas Fir	45.00	45.00	45.00	45.00	45.00	45.00	45.00	42.00	42.00	.....	.....
Pittsburgh	Southern Pine	30.50	31.90	37.65	33.75	36.52	37.50	47.75	.....	.....	57.50	57.50
	Douglas Fir	38.52	39.70	39.70	38.55	39.10	39.38	53.25	53.25	53.25	.....	.....
St Louis	Southern Pine	28.00*x	29.00*x	29.00*x	27.50*x	28.50*x	30.00*x	47.00*x	.....	.....	.....	.....
	Douglas Fir	.....	.....	.....	.....	.....	.....	.....	54.00*x	54.00*x	72.00	70.00
San Francisco	Douglas Fir	20.00f	20.00f	21.50f	21.50f	22.00f	22.50f	24.50	25.00f	25.00	.....	.....
Seattle	Douglas Fir	14.00	15.00	15.00	14.00	14.00	14.00	20.00	19.00	19.00	.....	.....

*Delivered. †Spruce. ‡Long-leafed Y. P. §Norway Pine. ^Northern Pine. =Native. fAt ship's tackle. yYard prices. d10% Disc. taken off. x5M ft. orless §S4S. RRgh. cContractors in Minneapolis and St. Paul get 15% disc. from list.

CURRENT BUILDING AND CONSTRUCTION WAGE RATES PER HOUR

	Bricklayers	Carpenters	Structural Iron Workers	Hoisting Engineers	Plasterers	Common Labor — Building	Common Labor — Heavy Const.
Atlanta	$0.70/1.125	$0.40/.90	$0.60/1.25	$0.75/1.50	$0.60/1.00	$0.30/.40	$0.30/.40
Baltimore	1.25	1.10	1.37½	1.25	1.25	.45	.45
Birmingham	1.00	.60/1.00	1.00	1.125	1.00	.30/.40†	.30/.40†
Boston	1.20	.70/1.175	1.20	.90/1.375	1.375	.50/.70	.50/.70
Cincinnati	.80/1.375	.65/1.20	1.25	1.00/1.25	.80/1.375	.45	.45
Chicago	1.50	1.50	1.50	1.3125	1.50	.95	.95
Cleveland	1.375	1.12½	1.25	1.25	1.375	.72	.72
Dallas	.50/1.00	.50/1.00	.50/1.00	.50/1.00	.50/1.00	.25/.40	.25/.40
Denver	1.10	1.10	1.10	.....	.....	.50	.50
Detroit	1.25	1.00	1.25	.75/.95	1.25	.55/.60	.55/.75
Kansas City	1.325	1.125	1.125	1.125	1.325	.70	.45/.50
Los Angeles	1.10	1.10	1.125	1.125	1.25	.50	.60
Minneapolis	1.00	.70/.85	1.00	.85	1.00	.40	.45/.50
New Orleans	1.00	.75	1.00	1.00	1.25	.30/.40	.30/.40
New York	1.50	1.40	1.475/1.65	1.50/1.65	1.50	.82½	.50/.80
Philadelphia	.35/1.50	.65/1.10	.70/1.375	.90/1.00	1.10/1.37	.35/50	.40/.50
Pittsburgh	1.00	1.00	1.00	1.00	1.00	.80	.50
St. Louis	1.50	1.25	1.47	1.35/1.47	1.50	.78¾	.35/.78¾
San Francisco	1.50*	1.10	1.37½	1.12½	1.25*	.62½	.60
Seattle	1.00	1.00	1.25	1.25	1.25	.60	.60
Montreal	1.00	1.00	1.25	1.25	1.25	.60	.60

Skilled Avg: (Bricklayers Carpenters, Ironworkers) $1.119 Common Avg. $0.5474 *6-hr. Day. †PWA.

CONSTRUCTION REPORTS

WATERWORKS

PROPOSED WORK

Calif., Los Angeles—Los Angeles Co. Water Dist. 21, c/o R. E. Shonerd, co. mechanical engr., Hall of Records Bldg., voted $70,000 bonds in Kagel Canyon Dist., near San Fernando, incl. 35,000 ft. 4- to 8-in. c.i. pipe, 50,000 gal. elevated steel tank tower, 10 ft. to bottom of tank, one deep well, 300 to 400 g.p.m. high head turbine pump, drilling water well 16 to 18 ft. diam., 500 ft. deep, etc. Noted Nov. 22, C. D.—Nov. 28, E. N.-R.

Calif., Seal Beach—City, final draft of official call for bids has been forwarded to P.W.A. for approval. Bid call to be issued soon for water system improvements in Seal Beach. $54,545. P.W.A. grant $24,545 has been approved and city has voted $30,000 bonds to finance project. Noted Apr. 8, C. D. —Apr. 11, E. N.-R.

Neb., Omaha — Metropolitan Utilities, 18th and Harney Sts., plans lowering 1,000 ft. 36 in watermain at Florence Station, $8,863; installing 12 in. watermains at 14th and Locust Sts., $16,463; installing 4 in. gas mains in Davenport St., $1,925. Total $27,463. J. C. Detweiler, const. engr. for owner. W.P.A. project.

N. J., Montville—Montclair Twp., Morris Co., soon takes bids constructing water supply and distribution system. $170,909. P.W.A. project. Clyde Potts, 30 Church St., New York, engr.

Tex., San Antonio—See "Unclassified."

Wash., Shelton—City, bids early in January installing pumps, wiring, 50,000 gal. aerating tank and pipes. Bids Dec. 5 rejected. B. Bantz, City Hall, Chehalis, engr. Noted Nov. 29, C. D.

Wis., Tigerton—Village rejected bids Dec. 10, constructing elevated steel tank on tower. $8,200 Will readvertise. Druar & Millinowski, 830 Globe Bldg., St. Paul, Minn., engrs. Noted Dec. 19, C. D.—Dec. 26, E. N.-R.

Ont., Port Nelson—Nelson Twp. Water Com., J. Moodie, chn., plans waterworks system, incl. pumps, $10,000; filter, $11,300; intake pipe, $19,800; chlorinator, $1,950; pump house and buildings, $18,700. G. H. Power, Watson St., Oakville, engr. Noted Oct. 28, C. D.—Oct. 31, E. N.-R.

Ont., Roseland—Lakeshore Utilities Ltd., 56 North John St., Hamilton, making plans water system, incl. building, $18,700; intake, $19,800; pump, $10,000; filter, $11,300; meter, $1,500; chlorinator, $1,950; electric wiring and equipment, $2,650.

BIDS ASKED

Ill., Farmersville—Jan. 10, by Village, J. M. Busche, pres., waterworks system. P.W.A. project. Warren & Van Praag, Inc., Decatur, engrs. Noted July 15, C. D.—July 18, E. N.-R.

Ill., Vienna—Jan. 7, by City, W. E. Smith, mayor, waterworks. $81,000. P.W.A. project. Warren & Van Praag, Inc., Decatur, engrs. Noted Dec. 16, C. D.

N. Y., Seneca Castle — See "Contracts Awarded."

Okla., Walters—See "Contracts Awarded."

B. C., Vancouver—See "Contracts Awarded."

Ont., London—See "Contracts Awarded."

CONTRACTS AWARDED

Ala., Montevallo — Alabama College, steam generating plant, incl. two 300 hp. water tube boilers, brick, stack and steel breeching, pumps and equipment, to Rust Eng. Co., Martin Bldg., Birmingham, $41,910. Bids Dec. 13, awarded Dec. 14. Rejected bids Dec. 13, 200,000 g.p.d. filter plant building, clear well, basin, filters, piping, pumps, chlorination, etc. Total est. $64,000. Noted Dec. 9, C. D.

Ala., Warrior—City filtration plant, river intake, pumps and distribution system, to Sullivan, Long & Haggerty, Bessemer, $29,392. Est. $28,500. **P.W.A.** Noted Dec. 9, C. D.

Ark., Mammoth Springs — City, S. Holt, mayor, drilling well, constructing elevated tank, pump house, complete distribution system, to B. M. Hogan, 115 North Spring St., Little Rock, $29,610***tank, to Chicago Bridge & Iron Wks., 37 West Van Buren St., Chicago, Ill., $6,475***well, to J. N. Watkins, $3,975. Grand total $40,060. Est. $45,000. **P.W.A.** Bids Dec. 12, awarded Dec. 12.

Calif., Los Angeles—D. P. Nicklin, purch. agt. Dpt. Water & Power, 207 South Broadway, furnishing 120,000 ft. laying length 8 in. ID. bell and spigot c.i. pipe, Spec. X2, to American Cast Iron Pipe Co., 412 West 6th St., f.o.b. Van Nuys, $72,600; to U. S. Pipe & Fdry. Co., 417 South Hill St., f.o.b. Hewitt St., $46,800; and to National Cast Iron Pipe Co., 625 South Western Ave., f.o.b. Slauson and Compton Aves., $23,500. Grand total $142,900. Noted Dec. 13, C. D.

Calif., San Francisco—Public Utilities, City Hall, constructing Calaveras chlorinating plant and extension to Irvington chlorinator building, involving 100 cu.yd. excav. all classes, 10 cu. yd. concrete, constructing Calaveras chlorinator building and extension to Irvington Portal Chlorinator Building, electric work, constructing 100 lin.ft. redwood trough and installing chlorine solution hose and about 500 ft. 2 in. pipe, Spec. W.D. 95, to M. J. Lynch, Oakdale and Barnevald Aves., $4,155. **P.W.A.** Bids Nov. 14, awarded Dec. 5. Noted Nov. 27, C. D.

Conn., Norwalk — City, filtration plant for waterworks, to T. F. Foley & Co., Inc., 81 Day St., South Norwalk, $41,380. **P.W.A.** Noted Dec. 17, C. D.

Ill., Pleasant Hill — Bd. City Trustees, to Henry Rees & Sons, Quincy, Sect. 1, distribution system, $28,612; Sect. 2, elevated tank on tower, $6,100; Sect. 3, 45 ft. 8 in. well drilled and cased, $830; Sect. 4, pump house, $5,190; to American Well Wks., Aurora, Sect. 5, one 100 g.p.m. deep well turbine pump and one 150 g.p.m. centrifugal high service pump, $693. Grand total $41,425. Est. $48,000. **P.W.A.** Noted Dec. 5, C. D.

Ia., Newton—City, furnishing, installing 500,000 gal. steel tank on tower, to Pittsburgh-Des Moines Steel Co., 1015 Tuttle St., Des Moines, $30,244. **P.W.A.** Bids Nov. 9. Noted Dec. 2, C. D.

Md., Towson—Comrs. Baltimore Co., excavating trenches, furnishing, laying 10,210 lin.ft. 6- to 12-in. c.i. mains, to Ligon & Ligon, 3310 Ridgewood Ave., Baltimore, $23,947. Est. $30,000. **P.W.A.** Noted Dec. 13, C. D.

Mass., Newbury—Town, A. E. Elwell, chn. Bd. Selectmen, Town Hall, constructing 7 mi. c.i. pipe watermains and appurtenances, to Anthony Ross & Son, 173 Bedford St., Lexington, $117,200. Est. $135,000. **P.W.A.** Bids Nov. 25. Noted Dec. 6, C. D.—Nov. 21, E. N.-R.

Mass., Northboro — Town, Bd. Selectmen, Town Hall, furnishing, laying 3 mi. watermains, together with hydrants, valves, house services, etc., to A. Piatelli & C. Di Martino, 56 Rockdale St., Mattapan, $53,603. **P.W.A.** Bids Nov. 14, awarded Dec. 13. Noted Dec. 17, C. D.—Dec. 26, E. N.-R., under "Contracts Awarded."

Mass., Randolph and Holbrook—Joint Water Bd., M. L. Coulter, chn., at Town Office Building, Randolph, waterworks improvements, Contr. A, to Clark & Smith, Inc., 1372 Hancock St., Quincy, $40,390; Contr. B, to Norwood Eng. Co., Florence, $13,800. P.W.A. project. Bids Nov. 22. Noted Dec. 3, C. D.—Nov. 21, E. N.-R.

Mich., Clifford—Village, C. Friday, clk., waterworks, incl. distribution mains, storage tank and pumping station, to M. T. Miljanic, 7620 Kendall Ave., Dearborn, $13,305. **P.W.A.** Bids Dec. 6. Noted Nov. 26, C. D.

Mich., Detroit—E. H. Bauer, secy. Bd. Water Supply, waterworks, incl. steam boiler and super-heater, 400 hp., to Keeler Co., Williamsport, $11,148; underfeed stoker for steam boiler, to American Eng. Co., Aramingo and Cumberland Sts., Phila., Pa., $9,478. Bids Dec. 10. **P.W.A.** Noted Dec. 3, C. D.—Dec. 5 E. N.-R.

Minn., Belview—Village, waterworks system, incl. 7,117 lin.ft. 2- to 8-in. c.i. pipe, to St. Cloud Constr. Co., St. Cloud, $11,800; tank on tower, to Challenge Co., 112 3rd Ave. N., Minneapolis, $5,720. **P.W.A.** Bids Dec. 14. Noted Dec. 9, C. D.—Nov. 21, E. N.-R.

Minn., Isle—Village, constructing waterworks system, 8,000 lin.ft. c.i. pipe, to W. W. Magee, 118 Central Ave. W., St. Paul, $16,671*** drilling 10 in. well, to P. J. Theim, Clara City, $1,610***50,000 gal. tank on 100 ft. tower, to Minneapolis-Moline Power Implement Co., 2844 Minnehaha Ave., Minneapolis, $7,350. Grand total $25,631. **P.W.A.** Bids Nov. 22. Noted Dec. 6, C. D.

Minn., Onamia—Village, W. J. Lynon, clk., 50,000 gal. steel tank on 100 ft. tower, to Minneapolis Steel & Mchy. Div. of Minneapolis-Moline Power Implement Co., 2844 Minnehaha Ave., Minneapolis, $7,200. **P.W.A.** Bids Nov. 9.

Minn., St. Paul—City, furnishing materials, constructing rein.-con. water conduit between Lake Pleasant and Sucker Lake, for water supply system, to Thornton Bros. Co., 1343 Dayton Ave., $89,000***200,000 gal. steel tanks on concrete foundation, to Lakeside Bridge & Steel Co., 2694 University Ave., $18,690*** 500,000 gal. elevated steel tank on concrete foundation at West St. Paul, to Pittsburgh-Des Moines Steel Co., 1015 Tuttle St., Des Moines, Ia., $33,139. Grand total $140,829. **P.W.A.** Bids Nov. 19.

Neb., Bruno—City, to Olson & Anderson, Oakland, test well for waterworks $80; 8 in. 80 ft. tubular well, $655***to Interstate Mchry. Co., 1006 Dodge St., Omaha, 80 g.p.m. turbine pump, $591***to Charles Robeck Co., Omaha, pump house, $1,200; 30,000 gal. steel tank on tower, $4,690; distribution system, hydrants and valves, $8,850. Grand total $16,066. **P.W.A.** Bids Nov. 22. Noted Nov. 13, C. D. — Nov. 21, E. N.-R.

Neb., Elba — City, steel tank on tower for waterworks, to Omaha Steel Wks., 48th and Leavenworth Sts., Omaha, $4,750. Total est. $18,856. **P.W.A.** Bids Dec. 13. Noted Dec. 19, C. D.

N. J., Trenton—City, connecting dead ends on various streets of Trenton, to Jesse Ailey, 139 Centre St., $18,476***watermains from Trenton to White Horse, to N. A. Bugbee Co., 206 East Hanover St., $113,977***6,000 ft. feed line Trenton to Broad St. Park, to Barrett Paving Co., 28 West State St., $42,817*** laying 24 in. pipe from Calhoun St., to Bloomsbury St., to Shelt Co., Elmira, N. Y., $18,528. Grand total $193,798. **P.W.A.**

N. M., Montainair—Town, constructing well, underground storage tank, 2 pump houses, tower and distribution system, to McClendon Co., Albuquerque, $24,907. Est. $32,727. **P.W.A.** Bids Dec. 5. R. F. Black, Santa Fe, engr.

N. Y., Plattsburg — City, water supply and filtration plant, to J. A. Munroe & Son, North Attleboro, Mass., $71,100. **P.W.A.** Bids Dec. 6. Noted Dec. 17, C. D.—Oct. 31, E. N.-R.

N. Y., Red Hook—Village, drilling well for waterworks, to Feller Bros., Red Hook. Total est. $63,892. **P.W.A.** Bids Nov. 8. Bids Dec. 30, on pipe, pump house, steel tank and equipment. Noted Dec. 2, C. D.—Aug. 8, E. N.-R.

N. Y., Seneca Castle—Village, constructing Seneca Castle Boulder Dam in Flint Creek, in Seneca to provide adequate water supply for Village of Seneca Castle, own forces. To exceed $12,000.

N. D., Jamestown—City, excavating and earth removal for water softening plant, to E. A. Moline, Jamestown, $3,066. Total est. $88,000. $60,000 bonds voted. **P.W.A.** G. R. Horton, city engr. E. L. Lium, Grand Forks, consult. engr.

N. D., Noonan — City, constructing waterworks, incl. 5,902 lin.ft. 6 and 8 in. c.i. mains, 13 hydrants, 2 wells, pump equipment, 50,000 gal. elevated tank, to J. A. Shaw Constr. Co., Fargo, $29,119. Est. $28,000. **P.W.A.** Bids Dec. 13. Noted Dec. 6, 1933, C. D.—Dec. 14, 1933, E. N.-R.

O., Bloomdale—City, general contract constructing waterworks, to C. D. Mitchell, $36,625***well, to R. F. Dunbar, Delta, $659. Est. $37,000. **P.W.A.** Noted Sept. 20, C. D.— Sept. 26, E. N.-R.

O., Milford—City, water softening and iron removal plant, to Downing & Hetrick, 12 North 3rd St., Columbus, $30,900. Est. $30,000. **P.W.A.** Hoover & Montgomery, Atlas Bldg., Columbus, engrs.

O., Monroe — City, constructing waterworks system, Contr. 4, pump house, to Atchley & Cast, Monroe, $468. **P.W.A.** Noted Apr. 12, C. D.—Apr. 18, E. N.-R.

O., Stryker—City, general contract constructing waterworks system, to W. L. Johnson, Toledo, $49,254; well, to R. F. Dunbar, Delta, $880. Est. $50,000. **P.W.A.** Noted Dec. 18, C. D.—Dec. 20, E. N.-R.

Okla., Ardmore—Bd. City Comrs., City Hall, filtration plant, to C. S. Clark Constr. Co.,

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◆

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Waterworks (Continued)

Petroleum Bldg., Oklahoma City. $42,500. P.W.A. Bids Dec. 14. Noted Dec. 4, C. D.—Nov. 28, E. N.-R.

Okla., Walters—City constructing new impounding reservoir, water supply, force account. W.P.A. project. $25,000. City voted bonds. W. L. Benham, Bass Bldg., Oklahoma City, engr.

Pa., Allentown — City, general contract constructing 1700 ft. flood wall around existing water works, to M. A. Long Co., Commonwealth Bldg., $133,728***electrical work, to H. N. Crowder, 400 Union St., $1,336***drainage equipment, to Wm. H. Taylor Co., Allentown, $2,215. Grand total $137,279. Est. $160,000. P.W.A. Noted Oct. 22, C. D.—Oct. 24, E. N.-R.

S. C., Summerville—Comrs. P. Wks., T. B. Moorer, secy., constructing complete water filtration plant, to Boyle Road & Bridge Co., Sumter, $28,861. P.W.A. Bids Dec. 11, awarded Dec. 18. Noted Dec. 3, C. D.—Dec. 5, E. N.-R.

S. D., Deadwood — City, waterworks improvements, incl. c.i. main extension, to Thompson Bros., Spearfish, $14,957. P.W.A. Bids Dec. 13. Noted Dec. 9, C. D.

Tex., Big Wells—City, c/o F. V. Standifer, mayor, waterworks system, general contract, to Cribbs & Davidson, Crystal City, $23,643*** tank and tower, to Taylor Iron Wks., Taylor, $5,600***pumping equipment, to Chicago Bridge & Iron Wks., Athletic Bldg., Dallas, $6,475***distribution, to Automatic Sprinkler Co., 2330 Summer St., Dallas, $6,250. Grand total $41,968. Est. $40,000. P.W.A. Bids Nov. 22. Noted Dec. 16, C. D.

Utah, Cleveland — Town Bd., materials for waterworks supply line, distribution system, incl. c.i. pipe fittings, hydrants, and chlorinator, to Waterworks Equipment Co., 149 West 2nd St., Salt Lake City, $9,232; labor for project, to Mullins & Wheeler, 22½ East 1st St., Salt Lake City, $9,300. Est. $20,000. Bids Nov. 30. Noted Nov. 6, C. D.

Utah, Mayfield — Town, labor for replacing wood pipe with 40,000 lin.ft. 2- to 8-in. c.i. pipe also distribution system, constructing waterworks, to Davies Constr. Co., Spanish Fork, $13,577***materials, to Waterworks Equipment Co., 149 West 2nd St. S., Salt Lake City, $19,692. Est. $35,000. P.W.A. Bids Nov. 20.

Utah, Ogden—City Comn., constructing pipeline from Polk Ave. and 23rd St. to Harrison Ave. and 2nd St., to Lynch-Cannon Eng. Co., Atlas Bldg., Salt Lake City, $17,357; materials, to G. A. Lowe Co., Ogden, $49,532. Est. $74,000. P.W.A. Bids Dec. 19. Noted Dec. 16, C. D.

Utah, Vernal—City, 15,900 lin.ft. 12 in. concrete pipe for waterworks, to Concrete Lock Joint Pipe Co., Denver, Colo., $10,117***8,200 lin.ft. 4 and 6 in. c.i. pipe, valves and hydrants, to Waterworks Equipment Co., 149 West 2nd St. S., Salt Lake City, $5,860***constructing waterworks, to Millins & Wheeler, 22½ East 1st St., S., Salt Lake City, $13,000. Grand total $28,977. Est. $30,000. P.W.A. Bids Nov. 23. Noted Nov. 1, C. D.—Nov. 7, E. N.-R.

Va, Amherst — Municipality, 600 tons c.i. pipe for waterworks, to Glamorgan Pipe & Fdry. Co., Lynchburg, Va., $20,000; 300,000 gal. water storage standpipe, to Chicago Bridge & Iron Wks., 37 West Van Buren St., Chicago, Ill.

Wash., Ridgefield — City, replacing existing mains with 18,200 ft. ¾- to 10-in. c.i. pipe, to Parker-Schram Co., Couch Bldg., Portland, Ore., $22,400. Est. $26,000. Noted Dec. 5, C. D.

Wash., Snohomish—City, rebuilding distribution system, incl. 29,875 ft. 4- to 12-in. c.i. pipe, to Queen City Constr. Co., 603 18th St. S., Seattle, $38,419. Est. $42,500. P.W.A. Noted Dec. 18, C. D.—Dec. 26, E. N.-R.

Wis., Tigerton—Village, pump house, to O. L. Sengstock, Tigerton, $1,096. P.W.A. Rejected bids for steel tower and tank. Noted Jan. 29, C. D.—Jan. 31, E. N.-R.

Wyo., Sheridan—City Council, constructing 300,000 gal. steel water tank, incl. 120 cu.yd. concrete, to Pittsburgh-Des Moines Steel Co., 1000 Tuttle St., Des Moines, Ia., $8,899. P.W.A. Noted Nov. 25, C. D.

B. C., Vancouver—Municipality, constructing feeder main, day labor. $56,000. C. Brackenridge, City Hall, engr.

Ont., Blenheim—P. Utilities Comn., constructing well to produce 125 g.p.m., to Jordan Roberts Sales Ltd., Brantford.

Ont., Guelph—Municipality, addition to deep well, to Jordan Robert Sales Ltd., Brantford, $12,500. Awarded Dec. 10. H. S. Nicklin, City Hall, engr.

Ont., Columbus—City, laying 4,000 ft. water main, relief labor. P. G. Purvis, twp. clk., in market for materials.

Ont., London—Pub. Utilities Comn. & Pub. Wks. Dpt., Ottawa, constructing reservoir, relief labor under supervision of Pub. Utilities Comn., $18,000.

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SEWERAGE AND WASTE DISPOSAL

PROPOSED WORK

Conn., Portland—Town, indefinitely postponed construction of sewage disposal plant. $80,000. N. L. Germain, engr., 135 Liberty St., Middletown, completed survey for same. Noted Oct. 2, C. D.—Oct. 10, E. N.-R.

Mo., Webster Groves—City received no bids Dec. 13, constructing sewers in Sanitary Sewer Dists. 13 and 14. P.W.A. project. Will readvertise. J. B. Clayton, city engr. Noted Dec. 11. C. D.

Neb., North Platte—See "Contracts Awarded."

N. J., New Providence—Boro soon takes bids sewers and sewage disposal plant. $151,304. P.W.A. project. Clyde Potts, 30 Church St., New York, engr.

R. I., Tiverton—Town plans additional sewer lines. $100,000. P.W.A. project. C. R. Lynch, Tiverton, consult. engr.

Tex., San Antonio—See "Unclassified."

Wis., Oshkosh—City rejected bids Dec. 13, constructing intercepting sewers. P.W.A. project. R. Cramer & Sons, 647 West Virginia St., Milwaukee, engrs. Will readvertise. Noted Dec. 19, C. D.

BIDS ASKED

Ill., Danville—Jan. 20, by Danville Sanitary Dist., constructing sewage treatment plant, Div. A: intercepting sewers, Div. B. Greeley & Hansen, 6 North Michigan Ave., Chicago, engrs.; adv. E. N.-R., Jan. 2. P.W.A. project. Noted Nov. 29, C. D.

N. Y., New York—Jan. 6, by Dpt. Sanitation, 125 Worth St., New York, intercepting sewers from East 138th St. to Jerome Ave., Contr. 12, Wards Island Sewage Treatment Works.

N. Y., St. George—Jan. 8, by J. A. Palma, pres. Richmond Boro, Boro Hall, sanitary sewers in Wiman Ave. and relay sewage pumping station on easterly side of Wiman Ave., 250 ft. south of Sweetwater Ave.

Que., Montreal—Jan. 8, by Executive Com., constructing Trenholm Ave. Trunk Sewer. Montreal Sewer Comn., City Hall, engr.

LOW BIDDERS

★ **N. Y., New York**—Dpt. Sanitation, T. W. Hammond, comr. Municipal Bldg., Dec. 23, pump and blower house superstructure for Wards Island Sewage Treatment Works, Contr. 1, from underpinning & Foundation Co., 155 East 44th St., $1,219,703***Manhattan Intercepting Sewers from West 164th to West 176th St., Contr. 9, and sewage flow regulators and branch intercepting sewers, Contr. 10, from DiMenna & Cleverock, Inc., 420 Lexington Ave., $91,326 and $874,164 respectively. Noted Dec. 6, C. D.—Dec. 12, E. N.-R.

CONTRACTS AWARDED

Ala., Pell City—City sanitary sewers and disposal plant, to Sullivan, Long & Haggerty, Bessemer, $29,396. Est. $30,000. P.W.A. Noted Dec. 9, C. D.—Dec. 12, E. N.-R.

Ala., Winfield—City, 37,500 ft. 4- to 10-in. pipe and 2 septic tanks, to Dimiljian & Boylston, 308 South 86th Pl., Birmingham, $40,900. Est. $51,000. P.W.A. Bids Dec. 13. Noted Dec. 9, C. D.—Dec. 12, E. N.-R.

Ark., Fayetteville — City, secondary sewage treatment plant, incl. 2 chlorinator houses, brick, 1 sprinkling filter of approximately 1 acre, rubble stone walls, feed and underdrainins, 1 prechlorinator equipment, to McGeorge Contg. Co., Pine Bluff, $96,686. Est. $100,000. P.W.A. Bids Dec. 13. Noted Dec. 11, C. D.—Dec. 19, E. N.-R.

Ark., Little Rock—R. E. Overman, mayor, constructing septic tank and extension of present system in District 103, to McEachin & McEachin, Rector Bldg., $5,693. (This is first section of $1,654,000 project.) Bids Dec. 12.

Mass., Foxboro — Commonwealth of Massachusetts, Dpt. Mental Diseases, State House, Boston, constructing additional sewers and sewage filters at State Hospital, to Lee Constr. Co., Inc., 133 Southampton St., Boston, $37,309. Bids Nov. 13, awarded Dec. 13. Noted Dec. 22, C. D.—Oct. 17, E. N.-R.

Minn., Clinton—Village, E. C. Gustafson, clk., sanitary sewerage system, to J. Byerly, Breckenridge, $22,070; Imhoff tank, etc., to Starbuck Constr. Co., Starbuck, $5,836. P.W.A. Bids Dec. 6. Noted Dec. 2, C. D.—Oct. 24, E. N.-R.

Minn., Park Rapids—Village, sanitary sewerage system, to Barnett & Record Co., 700 Flour Exchange, Minneapolis, $42,710; sewage treatment plant and lift station, to McGough Bros., 1954 University Ave., St. Paul, $24,100 and $2,500 respectively. Grand total $69,310. P.W.A. Bids Dec. 10. Noted Dec. 2, C. D.—Dec. 5, E. N.-R.

Mo., Kirkwood (St. Louis P. O.)—City, constructing sewage treatment plant, incl. extending outlet sewer in vicinity of Leffingwell Ave. and Short St., in southeastern section of city, to R. C. Micotto, 6918 Lansdowne Ave., St. Louis, $60,894. P.W.A. Bids Dec. 9. Noted Dec. 17, C. D.—Dec. 26, E. N.-R.

Neb., North Platte—City constructing sewage disposal plant, W.P.A. labor. $25,000. C. Coursey, 19 Neville Bldg., engr.

N. Y., Lockport—City, incinerator plant, to Amsler Morton Co., Fulton Bldg., Pittsburgh.

†*Federal Government.*

sewerage, etc. (Continued)

Pa., $56,500. **P.W.A.** Bids Dec. 9. Noted Dec. 3, C. D.—Dec. 5, E. N.-R.

N. Y., Riverhead—Municipality constructing sewerage system, to J. L. Sigretto & Sons, 405 Lexington Ave., New York, and Kearny, N. J., $117,046. **P.W.A.** Bids Dec. 5. Noted Dec. 12, C. D.—Nov. 21, E. N.-R.

N. Y., Watkins Glen—Village, sewage disposal plant on shore of Lake Seneca north of Porter St., to Cosmo DeLucca Constr. Co., 1608 DePeyster Ave., Utica, $42,899. Est. $50,000. **P.W.A.** Bids Dec. 13. Noted Dec. 10, C. D.—Dec. 5, E. N.-R.

O. Columbus—City, Sewage treatment works, Contr. 8, blowers and equipment, to The Elliott Co., Frick Bldg., Pittsburgh, Pa., $152,317. **P.W.A.**

O., Cleveland—City, Contr. 3 of Big Creek Intercepting Sewer, to D. M. Zullot Constr. Co., Box 157, Mill Rd., Brecksville, $77,164. **P.W.A.** Noted Dec. 11, C. D.—Dec. 19, E. N.-R.

O., Greenville—City, sewage disposal plant, incl. equipment, tanks, filter belts, pumping plant, trunk sewers, to Buesching & Hagerman, 402 East Superior St., Ft. Wayne, Ind., $134,725. Est. $130,000 plus. **P.W.A.** Noted Dec. 3, C. D.—Dec. 5, E. N.-R.

O., Navarre—Village, Contrs. A and B of sewage treatment project, to A. E. Freshwater & Son, Chester, W. Va., $86,032. **P.W.A.** Noted Aug. 19, C. D.—Aug. 22, E. N.-R.

Okla., Ardmore—Bd. City Comrs., City Hall, constructing West Side Sewage Disposal Plant, to D. Pray, Monett, $40,744. Bids Dec. 14. Noted Dec. 4, C. D.—Dec. 12, E. N.-R.

Wash., Elma—City, constructing trunk sewerage system and laterals in 12th St., incl. 23,690 ft. 8- to 18-in. vitr. clay pipe, to O. L. Soule & V. V. Walter, Elma, $47,034. **P.W.A.** Noted Dec. 16, C. D.—Dec. 19, E. N.-R.

Wash., Yakima—City, constructing incinerator, to Pittsburgh-Des Moines Steel Co., Neville Island, Pittsburgh, Pa., $39,900. **P.W.A.** A. B. Collins, City Hall, engr. Noted Dec. 18, C. D.—Dec. 26, E. N.-R.

Wis., Appleton — City, constructing sewage treatment plant, to Fluor Bros. & Smith, Inc., Oshkosh, $301,432. **P.W.A.** Bids Dec. 6. Noted Nov. 21, C. D.—Nov. 28, E. N.-R.

Man., Winnipeg—Municipality, constructing 4,170 lin.ft. 60 in. sewer in Broadway, Furby and Wolseley Sts., to Mutual Contractors Ltd., Winnipeg, $151,578.

Ont., London—City, constructing storm and sanitary sewers in Brydges St. area, sewers in Hale St., Wortley Rd. and Rectory St., scarifying of streets, repairs to gutters, curbs and walks, relief labor under City Dpt. $63,000.

Que., Montreal — Executive Com., sewer in Decarie Blvd., to Scardiere & Spineo, 7709 St. Laurent Blvd., $32,326. Noted Nov. 22, C. D.

BRIDGES AND GRADE CROSSINGS

PROPOSED WORK

Arizona—State Hy. Dpt., Phoenix, bids latter part of December, on realignment of grade crossing at Coldwater, Maricopa Co., 18 mi. west of Phoenix; realignment of 8.7 mi. U. S. Hy. 80, also eliminate 2 other grade crossings, $238,000.

N. C., Charlotte—State Hy. & P. Wks. Comn., Raleigh, plans West 6th St. underpass, prolongation of 6th St. west of Graham St., Mecklenburg Co. $335,000. W. L. Craven, Raleigh, bridge engr.

Texas — State Hy. Comn., H. Hines, chn., Austin, soon takes bids constructing Missouri, Kansas & Texas R. R. underpass and approaches and concrete pavement on Hy. 71, WPGH 488-C, Bastrop Co., $107,000; constructing Missouri, Kansas & Texas R. R. overpass, roadway approaches and concrete pavement on Hy. 68, WPGH 952-F, Johnson Co., $86,000; G. C. & S. F. R. R. underpass approaches and concrete pavement in city of Cleburne, Hy. 2, WPGM 288, Part 2, Johnson Co., $34,000; T. & P. R. R. underpass, approaches and concrete pavement on Hy. 5, WPGH 311-E, Red River Co., $102,846***G. C. & S. F. R. R. underpass, approaches, etc., Hy. 19, WPGM 370-B, Montgomery Co., $110,000; G. C. & S. F. R. R. overpass, roadway approaches, Hy. 105, WPGS 852-A, Montgomery Co., $60,000. New P.W.A. project.

BIDS ASKED

Iowa — Jan. 7, by State Hy. Comn., F. R. White, ch. engr., Ames, reconstructing 24x130 ft. concrete overpass and adding two 24x32 ft. I-beam approach spans on P. R. 3 at Wabash R.R. crossing east of Shenandoah, WPGH-524, Page Co., incl. 34,805 lb. reinforcing and 62,515 lb. structural steel, 155 cu.yd. Class 1 and 410 cu.yd. berm excav.; 8 concrete box and 14 concrete pipe culverts and extensions, 1 concrete arch culvert on secondary road out of Bloomfield south, WPSO-WPMS-55-AP, Davis Co., 445 cu.yd. Class 1 excav.; multiple span overpass structure consisting of 24x152 ft. cantilever I-beam bridge and 1 concrete pipe culvert, on P. R. 3 at C. B. & Q. R.R. crossing northwest of Nebraska City Junction, WPGH-581, Fremont Co.; 1 concrete box culvert, U. S. Rd. 59, WPMH-596, Cherokee Co., 400 cu.yd. excav.; 10 rein.-con. pipe and 4 rein.-con. box culverts on Rd. 58, WPSS-595, Black Hawk Co., 218 cu.yd. excav.; 21 concrete box culverts and 2 concrete flumes, of P.R. No. 82, Allamakee Co., 1,263 cu.yd. excav.; 24x150 ft. continuous I-beam bridge on secondary road from P. R. 178 east to P. R. No. 9, WPSO-574-C, Lyon and Osceola Counties, 100 cu.yd. Class 1, 145 cu.yd. Class 2 and 690 cu.yd. channel excav.; 24x210 ft. continuous I-beam highway grade separation structure, 2 concrete pipe culverts and relaying old cast iron and vitr. clay pipe, on U. S. Rd. 71, WPGM-154-A, Carroll Co., 525 cu.yd. Class 1 excav.; multiple span overpass structure over C. & N. W. Ry., consisting of 24x152 ft. three span cantilever and 24x201 ft. I-beam, and 1 concrete box culvert extension, 475 cu.yd. Class 1 excav., on same road, also one 24x66 ft. and two 24x51 ft. cantilever I-beam spans on same road, 427 cu.yd. Class 1 and 175 cu.yd. berm excav.

N. Y., New York—Jan. 17, by Transit Comn., 270 Madison Ave., reconstructing bridge carrying West 184th St. (West Fordham Rd.), over main line and Putnam Division of New York Central R.R., University Heights Station, Bronx Boro.

Ohio—See "Streets and Roads."

Oregon—See "Streets and Roads."

★ **Pa., McKeesport**—Allegheny Co. Authority, Pittsburgh, taking bids superstructure Jerome St. Bridge, Contr. 303. Estimated at several million dollars. E. L. Schmidt, County Office Bldg., Pittsburgh, engr. Noted July 1, C. D.—June 20, E. N.-R.

Wash., Mt. Vernon—Jan. 15, by Skagit Co. Comn., constructing Swinomish Channel Bridge. Noted Dec. 9, C. D.

LOW BIDDERS

★ **Kentucky** — State Hy. Comn., Frankfort, Dec. 20, track elevation on Louisville & Nashville R.R., beginning near St. Catherine St. and extending to point near Gay St., 1.632 mi. long, WPGM 475 AB, Jefferson Co., and grade separation structures at Breckinridge St., Brent St., Broadway, Walnut St. and Baxter Ave., from Henry Bickel Co., 435 Garden St., Louisville, $1,333,934***for track and trestle work only, from Arundel Corp., Pier 2, Pratt St., Baltimore, Md., $1,192,912***for grade separation structures from Geo. M. Eady Co., 340 Byrne St., Louisville, $340,323. Noted Dec. 3, C. D.—Dec. 6, E. N.-R.

CONTRACTS AWARDED

Colorado—State Hy. Dpt., Denver, concrete arch bridge across Pine Creek between Colorado Springs and Breed, on S. H. 1, El Paso Co., to Frank M. Kenney, 56 Steele St., Denver, $51,499. Bids Dec. 11, awarded Dec. 16. Noted Dec. 9, C. D.—Dec. 12, E. N.-R.

Colorado—State Hy. Dpt., Denver, railroad overpass with gravel surfaced approaches, WPGS 388-D, between Oak Creek and Phippsburg, on S. H. 131, Routt Co., to H. C. Lallin Constr. & Eng. Co., 6001 West 13th Ave., Denver, $41,105. Bids Dec. 11, awarded Dec. 16. Noted Dec. 9, C. D.—Dec. 12, E. N.-R.

Illinois—Dpt. P. Wks. & Bldg., Div. Hys., Springfield, substructure for subway, Perry Co., to H. R. Cawood, Mount Vernon, $29,385*** superstructure for same bridge, to Worden Allen Co., 208 South LaSalle St., Chicago, $25,998***subway in Macoupin Co., to Richardson Constr. Co., Decatur, $25,165***superstructure for same project, to Duffin Iron Co., 37 West Van Buren St., Chicago, $41,161***subway in Ogle Co., to St. Clair Constr. Co., Wheaton, $29,518***viaduct in Carroll Co., to A. Olson Constr. Co., Waterloo, Ia., $34,163***6 bridges in Hancock Co., to A. P. Munson, Marion, Ia., $77,935***bridge in Adams Co., to W. Wells & Sons, Quincy, $17,846***2 bridges in Fayette Co., to A. Culverson, Pana., $31,581***3 bridges and 4 culverts in Greene and Scott Counties, to P. McGlone, City Bank Bldg., Kansas City, Mo., $69,981***bridge in McLean Co., to Sullivan Constr. Wks., Sullivan, $20,420***substructure for bridge in Peoria Co., to Schmitt Constr. Co., Peoria, $22,944***superstructure for same bridge, to Vincennes Steel Corp., Vincennes, Ind., $21,568. Grand total $447,665. Bids Dec. 13. Noted Dec. 6, C. D.

Miss., Clarksdale—City, 470 ft. steel, rein.-con. bridge over Sunflower River at 2nd St., and removing 2 steel bridges, to Pigford Bros., Meridian, $72,674. Noted Dec. 5, C. D.

Missouri — State Hy. Comn., Jefferson City, bridges over drainage ditch; over side ditch, drainage ditch, and over Fox River, all in Clark Co., to Cameron Joyce & Co., Keokuk, Ia. Noted Oct. 18, C. D.

Missouri—State Hy. Dpt., Jefferson City, constructing bridges over Terrill Creek and over drain, Christian Co., to Garrett Constr. Co., Springfield. Bids Nov. 22. Rejected bids Nov. 22, constructing bridges in Nodaway and Jefferson Counties. Noted Dec. 6, C. D.

Neb., Wahoo — Saunders Co., constructing bridge at Ashland Ave. and 5 small bridges and rein.-con box culvert, to Central Bridge & Constr. Co., Wahoo, $40,239. **P.W.A.** Bids Dec. 7. Noted Dec. 9, C. D.—Dec. 12, E. N.-R.

New York — A. W. Brandt, comr. Hys., Albany, constructing bridges and culverts in Cortland Co., to H. M. Strong & Son, Whitney Point, $30,434***bridges in Nassau and Queens Counties, to Gifford Constr. Co., Inc., 161-10 Jamaica Ave., Jamaica, $140,796 est. $151,471

†Federal Government.

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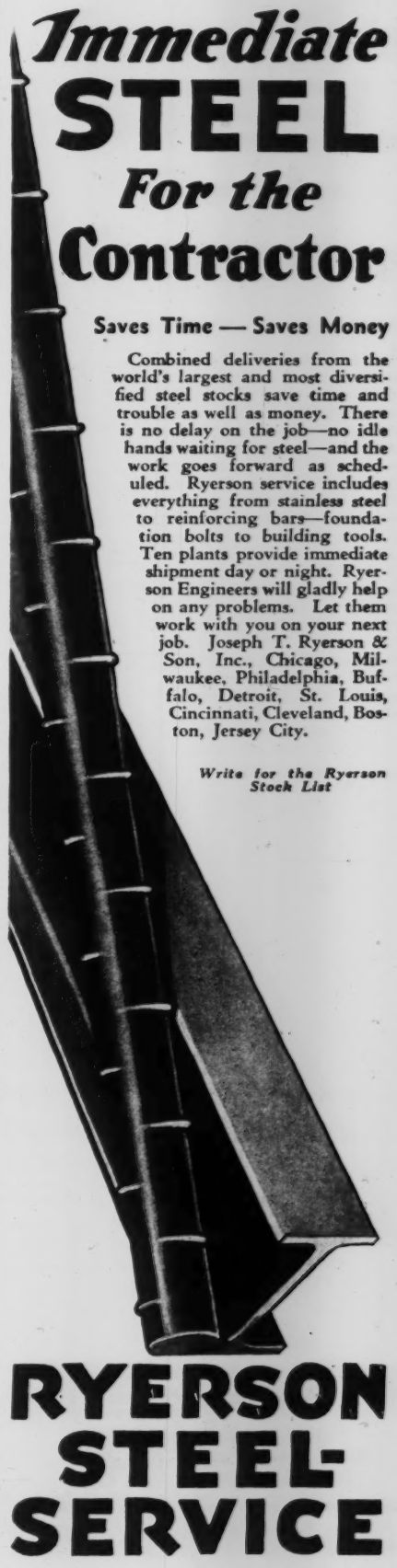
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Portable Belt Conveyors—Screens

Bridges, etc. (Continued)

•••Orleans Co., to Jodomar, Inc., Rochester, $28,385•••Erie Co., to E. Cerullo, Inc., Depew, $69,639. Grand total $269,253. Bids Dec. 6. Noted Dec. 12, C. D.—Nov. 21, E. N.-R.

Oklahoma—State Hy. Dpt., Oklahoma City, constructing overpass near Thomas, to Marveldt & Lawson, El Reno, $48,818 est. $55,893 •••overpass at Byars, McClain Co., to Nims & Frost, Hydro, $35,737 est. $35,737•••overpass, Oklahoma City, to Boardman & Co., Maple Hawk St., Oklahoma City, $136,949 est. $197,182•••120 ft. overpass, Tulsa, Owasso Co., to Pharoah & Co., Henryette, $61,240 est. $68,043 •••11 span, 550 ft. I-beam bridge on concrete piers, at Seiling, Dewey Co., to Ellis & Lewis, 507 Surety Bldg., Muskogee, $57,973. Grand total $340,717. Bids Dec. 19. Noted Dec. 11, C. D.

Texas—G. Gilchrist, state hy. engr., Austin, constructing I. & G. N. R.R., underpass and approaches on Hy. 6, WPGM 811, Comal Co., to Austin Bridge Co., 1813 Clarence St., Dallas, $72,856 est. $80,000•••G. H. & H. R.R. underpass and roadway approaches on Hy. 8, WPGM 512-F, Harris Co., to Russ Mitchell, Inc., 2701 Texas Ave., Houston, $62,814 est. $60,000••• G. C. & S. Fe R.R. overpass and approaches on Hy. 24, WPGH 623-C, Denton Co., to Purvis & Bertram, 112 West 9th St., Ft. Worth, $34,896 est. $40,000. Grand total $170,566. Bids Nov. 19. New **P.W.A.** Noted Nov. 25, C. D.

Texas—G. Gilchrist, state hy. engr., Austin, constructing Altoyac River Relief Bridge and Niciper Creek Bridge, Hy. 21, Control 118-10-4, San Augustine Co., to W. S. Crawford Co., Dallas, $46,259. Est. $45,000. Bids Dec. 3. Noted Dec. 10, C. D.

Texas—G. Gilchrist, state hy. engr., Austin, constructing 3 concrete box culverts and one concrete deck girder bridge having four 30 ft. spans, Hy. 73, F.A.P. 805 E and F, Fort Bend and Waller Counties, to Austin Bridge Co., 1813 Clarence St., Dallas, $23,787. Est. $20,000. Bids Nov. 19. Noted Nov. 25, C. D.

★ **Tex., Galveston**—State Hy. Comn., G. Gilchrist, engr., Austin, constructing substructure, superstructure and approaches for causeway from Galveston Island to Virginia Point Control 51-4, Contrs. A, B and D, combined, to Austin Bridge Co., 1813 Clarence St., Dallas, and Galveston, $1,675,027. Est. $1,500,000. **P.W.A.** Bids Dec. 11. Noted Nov. 29, C. D.—Dec. 19, E. N.-R.

Tex., Houston—Harris Co., c/o H. L. Washburn, aud., constructing Market St. bridge approaches, rebuild for San Jacinto Bridge, to Brown & Root, Inc., 4300 Calhoun St., $79,704. Est. $75,000. **P.W.A.** Bids Dec. 6. Noted Dec. 4, C. D.

★ **Tex., Port Arthur** — State Hy. Comn., Austin, and Jefferson Co., constructing bridge over Neches River, 6 mi. northeast of here between Port Arthur and Beaumont, to Union Bridge & Constr. Co., B.M.A. Bldg., Kansas City, Mo., $828,740. Est. $900,000. **P.W.A.** Bids Dec. 11. Noted Dec. 12, C. D.—Nov. 28, E. N.-R.

★ **Washington** — Director Hys. Olympia, constructing city street 1st Ave. South overcrossing in Seattle, King Co., Contr. 2073, to P. P. Gjarde, 816 Joshua Green Bldg., Seattle, $553,505; constructing 4,000 lin.ft. rein.-con. bridge, Olympia to Nisqually, Nisqually River Bridge approaches and slough bridges, Pierce and Thurston Counties, Contr. 2069, to Rumsey & Co., 3821 Airport Way, Seattle, $376,728.

Wisconsin—See "Streets and Roads."

Ont., Burlington—Canadian Natl. Hy., T. T. Irving, engr. Central Div., Union Station, Toronto, constructing concrete bridge on Hy. 25, to A. Cope & Son, Ltd., 19 Albert St., Hamilton, about $60,000; approaches and grading, day labor. Total est. $200,000. Bids Nov. 29. Noted Oct. 11, C. D.—Oct. 17, E. N.-R.

Que., Ascot—Provincial Dpt. P. Wks., Quebec City, concrete and steel work for bridge across St. Francis River, to MacKinnon Steel Corp., Ltd., Sherbrooke, $31,000. Noted Nov. 15, C. D.—Nov. 21, E. N.-R.

STREETS AND ROADS

BIDS ASKED

Indiana—Jan. 7, by State Hy. Comn., J. D. Adams, chn., State House, Indianapolis, surface treated waterbound macadam and crushed stone or gravel surface paving 6.371 mi. State Rd. 25, State Rd. 14 to mile S.W. of Talma, Contr. R-1247 Fulton Co.; 8.407 mi. State Rd. 39, Danville to Lizton, Contr. R-1250 Hendricks Co.: rein.-con., bituminous concrete or rock asphalt paving 5.194 mi. State Rd. 41, one mi. north of Vanderburgh Co. Line to ½ mi. east of Ft. Branch, Contr. R-1295 Gibson Co.: rock asphalt surfacing 0.316 mi. State Rd. 2, Cavin St., Ligonier, Contr. R-1296, Noble Co.: rein.-con. paving 1.841 mi. State Rd. 20, 5th Ave., Gary, Contr. R-1297, Lake Co.: waterbound macadam and bituminous paving 7.325 mi. State Rd. 234, 1½ mi. east of Ladoga to Jamestown, Contr. R-1298, Montgomery Co.: 14.952 mi. State Rd. 234, from State Rd. 43 to Jamestown, Contr. R-1299, Montgomery, Hendricks and Boone Counties; crushed stone or gravel surface and shoulder widening 7.345 mi. Feeder Rd., Fremont East to Michigan State Line, Fremont, Contr. R-1300, Steuben Co.: stone or gravel surfacing 6.176 mi. Feeder Rd., Velpen to point 3 mi. northeast of Pikeville, Velpen, Contr. R-1301; 5.981 mi. Feeder Rd., Velpen to State Rd. 56, Velpen, Contr. R-1302, both Pike Co.: 4.706 mi. Feeder Rd., State Rd. 52 to Zionsville, Contr. R-1303, Boone Co.: 8.967 mi. Feeder Rd., Albion to State Rd. 3, Albion, Contr. R-1304, Noble Co.; 6.555 mi. State Rd. 1, ½ mi. northeast of Pulaski to Winamac, Contr. 1305, Pulaski Co.; bituminous retread on 12.4 mi. State Rd. 116, Markle to Bluffton, Contr. 116, Huntington and Wells Counties. M. R. Keefe, State House Annex, Indianapolis, engr.

Iowa—Jan. 7, by State Hy. Comn., F. R. White, ch. engr., Ames, grading 7.289 mi. F.A.P. 42, U. S. Rd. 63, Wappello Co., incl. 12,500 cu.yd. excav.; 8.432 mi. and 40 corrugated metal 12 concrete pipe culverts, F.A.P. 443-B, P.R. 182, Allamakee Co., 351,123 cu.yd. excav.; 2.175 mi. WPSS 595, P.R. 58, Black Hawk Co., 38,814 cu.yd. excav.; 0.987 mi. WPGM 154-H, Carroll Co., 110,774 cu.yd. excav.; 0.314 mi. WPGH 581, P.R. 3, Fremont Co., 81,902 cu.yd. excav.; 3.894 mi. WPSO-WPMS 550-B, Davis Co., 76,558 cu.yd. excav.; 10.116 mi. F.A.P. 56-BC, Rd. 63, Davis Co., 21,400 cu.yd. excav.; paving 1.393 mi. WPMH 596, Rd. 26, Cherokee Co., 6,957 cu.yd. excav.; 0.57 mi. WPMH-573, Rd. 105, Mitchell Co., 1,548 cu.yd. excav.

Kansas—St. Hy. Comn., Independence, withdrew bids to have been opened Dec. 20, improving Projects 57-32-WPGH 372-B, Crawford Co., and 59-17-WPGH-D, Franklin Co.

Kansas—Jan. 7, by State Hy. Comn., at office of County Clerk, St. Francis, light type surfacing, earthwork, culverts, sand gravel surfacing, curbing, concrete paving, guttering, bridging 33,936 mi. hys. in Sheridan, Russell, Rooks, Norton, Ellis, Cheyenne and Decatur Counties.

Louisiana—Jan. 8 by State Hy. Comn., Baton Rouge (**P. means Project**), grading, surfacing 7.481 mi. Bourg-Larose Rd., Route 966, Project 610-B, Lafourche Parish; 3.314 mi. Coules Des Coures-Int. Route 5 Hy., Route 1160, P. 886-A, Avoyelles Parish; 6.168 mi. Lewisburg-Pitreville Hy., Route 767, P. 914-A, St. Landry Parish; 7 mi. Jefferson Davis Hys. Group 1, Route 714, P. 1086 Jeff Davis Parish; 6 mi. Calhoun-Cadeville Rd. Route 201, P. 1087, Ouachita Parish; 2.5 mi. Fluker-Int. 1093, Route 868, P. 1088, Tangipahoa Parish; 5.3 mi. West Baton Rouge Hy., Group 1, Routes C-1408 and C-1409, P. 1089, West Baton Rouge Parish; 5.5 mi. Int. Route 3-Jackson Hy., Route 323, P. 1090, West Feliciana Parish; 8.616 mi. Ascension Hys., Group 2, Routes 758, 179, C-1410, C-1411, C-1418, and C-1419, P. 1091, Ascension Parish; 9.122 mi. Tensas Hys., Group 2, Routes 463 and 349, P. 1095, Tensas Parish; 4.077 mi. Sid Humphrey Rd., Route C-1412, P. 1096, Morehouse Parish; 2 mi. Int. Route 30-Belle View Plantation Hy., Route C-1413, P. 1097, Iberville Parish; surfacing 2.14 mi. Ft. Necessity-Turkey Creek Rd., Route 169, P. 692-C, Franklin Co.; 7.677 mi. Rosefield Enterprise Rd., Route 68, P. 770-A-2, readvertised Catahoula Parish; 6.5 mi. Paradise-Bayou Des Allemands Hy., Route 669, P. 1093, St. Charles Parish.

Louisiana—Jan. 8, by State Hy. Comn., Baton Rouge, gravel surfacing and other work 7.677 mi. Rosefield-Enterprise Hy., Route 68, Project 770-A-2, Catahoula Parish; grading, gravel surfacing, etc., 3.37 mi. Sikes-Olla Hy., Route 990, Project 812-G, WPSO 292, Winn Parish; grading, washed gravel surfacing 4.128 mi. Jones' Bayou-Montery Hy. Route 820, Project 880-A, WPSO 265, Catahoula Parish; grading, clam or reef shell surfacing 1.629 mi. Airline Reserve Hy., Project 977-A, WPSO 284, St. John the Baptist Parish; concrete paving 2.767 mi. Batchelor-Innis Hy., State Project 4805-C, Pointe Coupee Parish; grading, drainage structures, shell surfacing 9.925 mi. Hackberry-Bayou-Chopique Hy., Route 104, Project 1913-A-L, N.R.H. 188-B, Cameron and Calcasieu Parishes; grading, surfacing 6 mi. Calhoun-Cadeville, Project 1087, Ouachita Parish; grading, surfacing, etc., 7 mi. Routes 701, 703, 714, Project 1086, Jefferson Davis Parish; grading, gravel surfacing 4.98 mi. Liddieville-Fort Necessity Hy., Routes 642 and 956, Project 842-A, WPSO 270, Franklin Parish; 7.481 mi. Bourg-Larose Hy., Project 610-B, La Fourche Parish; 2.14 mi. Fort Necessity-Turkey Creek Hy., Route 169, Project 692-C, Franklin Parish; grading, surfacing, etc., 3.314 mi. Coules Des Coures-Intersection Route 5, Hy., Project 886-A, Avoyelles Parish; 6.168 mi. Lewisburg-Pitreville Hy., Route 767, Project 914-A, St. Landry Parish; 2.5 mi. Fluker-Intersection Route 1093, Hy., Route 868, Project 1088, Tangipahoa Parish; 5.3 mi. West Baton Rouge Hy., Group 1, Routes C-1408 and C-1409, Project 189, West Baton Rouge Parish; 5.5 mi. Intersection Route 3, Jackson Hy., Project 1090, Route 323, West Feliciana Parish; 5 mi. Ascension Hys., Group 2, Routes 758, 179, C-1410-C-1411, Project 1091, Ascension Parish; 6.5 mi. Paradis-Bayou Des Allemands Hy., Route 669, Project 1093, St. Charles Parish; 9.122 mi. Routes 463 and 349, Project 1095, Tensas Parish; 4.077 mi. Sid Humphrey Rd., Route U-1412, Project 1096, Morehouse Parish; 2 mi. Intersection Route 30-Belle View Plantation Hy., Route G-1413, Project 1097, Iberville Parish.

N. Y., Brooklyn—Jan. 8 by R. V. Ingersoll, pres. Brooklyn Boro, Boro Hall, asphalt on 6 in. concrete paving Clermont Ave., Hendrix, Herkimer and Madison Sts.

★ **Ohio**—Jan. 7, at office Director State Hy. Dpt., Columbus, grading, drainage structures, brick paving 2.993 mi. Athens Co., $207,

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†*Federal Government.*

Streets and Roads (Continued)

931***grading, drainage structures, traffic bound surface paving 0.045 mi. Clermont Co. $8,560***grading, drainage structures, concrete paving 2.239 mi. Lucas Co., $223,618***grading, drainage structures, rein.-con. resurfacing 0.416 mi. Montgomery Co., $89,220; 1.637 mi. Mercer Co., $66,746; grading draining, rein.-con. resurfacing, bridging 3.092 mi. Mercer Co., $134,995***grading, concrete paving 4.236 mi. Miami Co., $79,413***grading, drainage structures, brick and bituminous surface treatment 1.349 mi. Wyandot Co. Total est. $1,078,916.

Oregon—Jan. 10, by State Hy. Comn., Salem, crushed rock surfacing and oil mat surfacing 8.46 mi. 4 sections county highway, Columbia Co.; grading 3.5 mi. Upper Tumalo Falls-Bend Co. Rd., Deshutes Co.; bituminous macadam paving 3.06 mi. Humphrey Blvd.-45th Ave. and Cameron Rd., Multnomah Co.; crushed rock in stockpile on Elgin-Rock Creek Production Project, Union and Wallow Counties; steel, timber bridge over Owyhee River on Jordon Creek Section, Malheur Co.; undercrossing under Southern Pacific Co.'s tracks and grading 0.27 mi. Pacific Hy. at North Salem city limits, Marion Co.; overcrossing over P.W.R.&N. Co.'s tracks and grading, paving 0.26 mi. 102nd Ave. near Portland; undercrossing under Oregon Electric Railway tracks and grading, surfacing 0.19 mi. Beaverton-Aurora Secondary Hy., Metzger, Washington Co.

Pennsylvania—Dpt. Hys., Harrisburg, rejected bids Dec. 16, bituminous on native stone surfacing 4.04 mi. Route 18, Point and West Chillisquaque Twps., Northumberland Co. W.P.A. project. Will readvertise.

CONTRACTS AWARDED

Alabama—State Hy. Comn., G. Scott, pres., Montgomery, double bituminous surface treating 0.353 mi. Day St., Montgomery Co., to Walters & Grant, Troy, $6,791***concrete and asphalt paving 0.531 mi. hy. Gadsden, NRM 104-E, Etowah Co., to C. G. Kershaw Contg. Co., Martin Bldg., Birmingham, $38,093. Bids Nov. 8. Noted Nov. 25, C. D.

California — State Hy. Comn., Sacramento, grading 1.3 mi. hy. between east entrance of Kern Co., Park and 1.25 mi. easterly, Kern Co., to Stewart and Nuss & J. Jurkovich, 410 Thorne Ave., Fresno, joint bid, $34,330. Bids Dec. 3, awarded Dec. 13. Rejected bids Dec. 3, grading, shoulders 6.3 mi. hy. between point 2 mi. south of Lemoore and point 1½ mi. east of Stratford, Kings Co. Noted Dec. 18, C. D.—Nov. 28, E. N.-R.

Calif., Oakland—City Council, improving Adeline St. between Aileen St. and Stamford Ave., involving 81,758 sq. ft. grading, incl. 4 in. rock subbase, 74,930 sq. ft. penetration macadam pavement, concrete curbs, guttering, storm water inlets, to L. J. Immel, 1031 Evelyn St., Berkeley, $13,561; Foothill Blvd. between 14th and 23rd Aves., 251,745 sq.ft. grading, incl. construction of rock sub-base, curbs, gutters, 211,427 sq. ft. concrete pavement, concrete driveways, sidewalks, etc., to Union Paving Co., Call Bldg., San Francisco, $66,713. P.W.A. Bids Nov. 21, awarded Dec. 12. Noted Dec. 6, C.D.

Colorado—State Hy. Dpt. Denver, gravel surfacing 6.742 mi. between Springfield and Campo, Baca Co., to Pople Bros. Constr. Co., Pueblo, Colo., $48,213. Bids Dec. 10, awarded Dec. 14. Noted Dec. 16, C. D.—Dec. 19, E. N.-R.

Colorado—State Hy. Dpt., Denver, gravel surfacing 9.921 mi. WPSS 402B between Eads and Shivington on S.H. 96, Kiowa Co., to Monaghan & Kenney, 332 South Race St., Denver, $83,636, gravel surfacing 3 mi. WPSS359-C between Ordway and Limon on S.H. 71, Crowley Co., to W. F. Pigg & Son, Commonwealth Bldg., Denver, $13,157. Bids Dec. 11, awarded Dec. 16. Noted Dec. 9, C.D.—Dec. 12, E.N.-R.

Illinois—Dpt. P. Wks. & Buildings, Div. Hys., Springfield, 16 ft. traffic bound surfacing 3.2017 mi. and grading 3.0217 mi. roadway near Renault, Monroe Co., to Ulen & Gandy, Ullin, $19,143, and Bangert Bros. Constr. Co., 8855 St. Charles Rd., St. Louis, $9,847 respectively ***traffic bound surfacing 5.3989 mi. road near Macon, Macon Co., to Birt Bros., Decatur, $30,457***4.4769 mi. road near Spring Garden, Jefferson Co., to Mautz & Oron, Effingham, $28,538. Grand total $87,985.

Ill., Berwick—Monmouth Co., R. Neff, comr., Court house, paving 24¼ mi. Berwick Twp. Bond Issue Roads and 26 mi. in Greenbush Twp. Bond Issue Roads, to T. Tomlianovich, Canton, $1.80 and $1.85 per cu.yd. respectively. P.W.A. Noted Nov. 25, C. D.—Nov. 28, E. N.-R.

★ **Illinois**—Dpt. P. Wks. & Buildings, Div. Hys., Springfield, paving 0.47 mi. Stephenson Co., to E. M. Rocho, Freeport, $73,996*** 0.71 mi Perry Co., to W. Lough & Sons, Marion, $37,593***0.36 mi. Macoupin Co., to Madison Constr. Co., Edwardsville, $59,303***079 mi. Cook Co., to J. A. Sackley Co., 4608 Belmont Ave. Chicago, $147,833***0.65 mi. Carroll Co., to McCarthy Impvt. Co., Davenport, Ia., $64,549 ***widening approach in Carroll Co., to St. Clair Constr. Co., Wheaton, $3 982***2.39 mi. Clark Co., to J. W. Etchison, Casey, $43,471 ***7.98 mi. Coles Co., to West Counties Constr. Co., Kennelworth, $53,301***3.58 mi. Cumberland Co., to Triangle Constr. Co., Kankakee $28,774***9.36 mi. in Fayette Co., to Mautz & Oren, Inc., Effingham, $74,843***4.57 mi. Knox Co. and 18.58 mi. Livingston Co., to Joyce Bros. Constr. Co., Springfield, $28,624 and $59 565 respectively***1.13 mi. Macoupin Co. and 5.18 mi. Macoupin Co., to Waukegan Constr. Co., Morton Grove, $25,094 and $68,800 respectively***5.09 mi. Mason Co., to Valley Eng. Co., St. Charles, $29,356***8.71 mi. Montgomery Co., to Powers Constr. Co., Bloomington, $68 219***3 mi. road from south of Pekin to Mason Co. line, Tazewell Co., to Valley Eng. Co., St. Charles, $23,220. Grand total $890,823. Bids Dec. 13. Noted Dec. 6, C. D.

Ill., Salem—Marion Co., traffic bound surfacing 4.8086 mi. various streets, to French Constr. Co., Fairfield, $28,741. P.W.A. Bids Nov. 15, Noted Nov. 7, C. D.

★ **Louisiana**—State Hy. Comn., Baton Rouge, to Barber Bros. Contg. Co., Baton Rouge, grading, washed gravel surfacing 5.732 mi. De Soto-Sabine Line Intersection Route 412, P. 776-C, Sabine Parish, $46,723; 3.125 mi. Forest-Bayou Macon Bridge Hy., Project 847-A, West Carroll Parish, $19,694; 3.062 mi. Intersection Route 732, Route 716, Project 1032, Jefferson Davis Parish, $26,666***to Nelson Bros., Baton Rouge, 5.512 mi. Waverly-Warsaw Hy., Project 825-C, Madison Parish, $44,640; 5.482 mi. Intersection Route 48-Intersection Route 687, Project 830-A, Tensas Parish, $40,061; 1.5 mi. Intersection Route 131-Intersection Route 335 Hy., Project 1044, Livingston Parish, $6,104***to J. J. McKeithen, Grayson, 2,738 mi. Red River-Cloutierville Hy., Project 835-B, Natchitoches Parish $17,536***to Forcum-James Co., Dyersburg, Tenn., 4.185 mi. Belle Bowe-Francisville Hy., Project 854-A, De Soto Parish, $25,713***to Reynolds & Sutton, Tyler, Tex., 4.405 mi. Lenton-Intersection Route 185 Hy., Project 857-A, Webster Parish $30,631*** to M. L. Hoffman, Jr., Madisonville, 6.373 mi. Intersection Route 35-Husser Hy., Project 1037, Tangipahoa Parish, $24,968***to R. B. Tyler Co., Inc., 1446 Levering St., Louisville, Ky., 3 mi. Intersection Route 71-Sunny Hill Hy., Project 1039, Tangipahoa and Washington Parishes, $10,210***to J. W. King, Columbia, 12.5 mi. Archibaldbef's Bayou Hy., Project 1045, Richland Parish, $56,874***to W. R. Aldrich, Baton Rouge, 5.5 mi. Siadous Ridge-South Hy., Project 1047, Lafayette and Vermillion Parishes $29,269***to Flenniken Constr. Co., Shreveport, 7 mi. Rodessa-Ida Hy., Project 1043, Caddo Parish, $25,753; surface treating 5.002 mi. Sarepta-North Hy., Project 6959, Webster Parish, $81,492***to F. J. D'Autremont, Jacksonville, Tex., grading, sand clay gravel surfacing 7.181 mi. St. Joseph-New Light Hy., Project 1042, Tensas Parish $51,229***to I. M. Goldberg, Abbeville, grading, reef shell surfacing 11.7 mi. Vermilion Hy., Project 1046, Vermilion Parish, $64,777***to Peters-Courtney Eng. Const. Co., Lake Charles, 4.847 mi. Intersectional Route 211-Intersectional Route 211 Hy., Project 1015, Calcasieu Parish, $25.120***to J. F. Campbell & Co., New Orleans, grading, clam or reef shell surfacing 1.723 mi. Airline Hy.-St. Rose Hy., Project 9683, St. Charles Parish, $10,237***to T. W. Kleimpeter, Baton Rouge, grading, sand clay surfacing 4.128 mi. Cole's Island Rd. Hy., Project 1013, Avoyelles Parish, $19,900***to Central Constr. Co., Inc., Monroe, concrete paving 6.578 mi. Bonita-Arkansas State Line Hy. Project 4303-C, Morehouse Parish, $167,798*** to Huth Constr. Co., Inc., Franklin, grading, drainage structures 5.377 mi. Intracoastal Canal Calcasieu Parish Line Hy., Project 970-O, Cameron Parish, $26,672. Grand total $852,067. Bids Dec. 4. State Hy. Comn. Baton Rouge, rejected bids Dec. 4, improving 1.629 mi. Airline Reserve Hy., St. John the Baptist Parish; and 4.128 mi. Catahoula Parish. Noted Nov. 19, C.D. and Nov. 21 and 28, E.N.-R.

★ **Louisiana**—State Hy. Comn., Baton Rouge, grading, gravel surfacing 2.65 mi. Air Line Hy.-Garyville Hy., Project 978-A, St. John the Baptist Parish, to R. B. Tyler Co., 1446 Levering St., Louisville, Ky., $15,559***5.019 mi. Pine Prairie-Beaver Hy. Project 727-A, Evangeline Parish, to Martin & Nichols, Alexandria, $23,690***5.428 mi. Frey-Mowata-Intersection Route 26, Routes 580 and 1028, Project 846-A, Acadia Parish, to Reynolds & Sutton, Tyler, Tex., $27,446***4.5 mi. Joe's Bayou-North Hy., Project 846-B, East Carroll Parish, to Barber Bros. Constr. Co., Baton Rouge, $34,152*** 5.265 mi. Hyatt-Juanita Hy., Route 287, Project 895-C, Beauregard Parish, to A. A. Fuller, Merryville, $28,396***7.276 mi. Ville-Platte Pine Point Hy., Route 570, Project 916-A, Evangeline Parish, to R. M. Lilly, Shreveport, $48,114***7.7 mi. Tickfaw Morris Retreat Hy., Route 1080, Project A-I, Tangipahoa Parish, to M. L. Hoffman Jr., Madisonville, $37,298***6.8 mi. Fort Barre-Leonville Hy., Route 238, Project 1006, St. Landry Parish, to W. R. Aldrich, Baton Rouge, $30,199***2.3 mi. Brule St. Martin Grand Bayou Hy., Route 566, Project 1030, Iberville and Assumption Parishes, to National Constr. Co., 501 North Olympia St., New Orleans, $5,604***6.405 mi. Blonde Post Office-Intersection Route 264 Hy., Project 1033, Washington and St. Tammany Parishes, to Kivet & Reel Sun, $34,595***2.038 mi. Felixville-Southwest Hy., Route 1078, Project 1040, East Feliciana Parish, to Robinson & Young, Baton Rouge, $12,232***4.034 mi. Ida-Missionary Hy., Route 991, Project 1051, Caddo Parish, to Flenniken Constr. Co., Shreveport, $22 152*** 10.25 mi. hys. on Routes 529, 759, 267, C-1377, C-1378 and C-1379, Project 1053, to N. Cardinal & Co., Plaquemine, $43,073***6.1 mi. Lismore and Calhoun Landing Roads, Routes C-1380 and C-1381, Project 1054, Concordia Parish to A. E. Montgomery, Parhams, $26,637*** 7 mi.

†Federal Government.

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Streets and Roads (Continued)

Intersection Route 10, Hickory Grove Hy., Route 1005, Project 1055, Red River Parish, to L. H. Hankins, Natchitoches, $40,649***grading, iron ore surfacing 4.89 mi. Zwolle-Ebarb School Hy., Route 402, Project 761-D, Sabine Parish, to Nelson Bros., Baton Rouge, $22,420***5.996 mi. Mt. Union Church-Arkansas State Line Hy. Route 440, Project 820-A, Union Parish to Delony & Tatum, Dubach, $16,446***grading, shell surfacing 12.083 mi. Klondyke Rd. Hy., Route C-1332, Project 1011, Cameron and Vermillion Parishes, to Doullut & Ewin, Inc., Q. & C. Bldg., New Orleans, $59,245. Grand total $527,907. Bids Dec. 11. State Hy. Comn., Baton Rouge, rejected bids Dec. 11, improving 9 mi. Oakdale Bond Hy., Route 1370, Project 1052, Allen Parish. Noted Nov. 25, C. D. and Dec. 6, C. D.—Nov. 28, E. N.-R.

Michigan—State Hy. Dpt., Lansing, shaping, concrete paving 0.279 mi. WPGH-82-27C-8 Wayne Co., to J. Porath, 702 Transportation Bldg., Detroit, $27,917***grading, shaping, drainage structures, concrete paving, 4.653 mi. WPSO 45-15C-2, Leelanau Co., to Remus Constr. Co., Remus, $137,072***grading, drainage structures 0.559 mi. WPGH 13-27, Calhoun Co., to Walraven Bros., Bay City, $36,670. Grand total $201,659. Bids Dec. 3. Noted Dec. 12, C. D.

Miss., Pascagoula—Bd. Supervs. Jackson Co., constructing Browns Bridge Road and bridges in Supervs. Dist. 1, incl. 24,116 cu.yd. excav. and embankment, 9,570 ft. creosoted piling, 179,066 B. M. creosoted timber, 64,076 lb. structural steel, to Newson Bros., Columbia, $36,209. **P.W.A.** Noted Nov. 29, C. D.—Dec. 5, E. N.-R.

Missouri—State Hy. Dpt., Jefferson City, to Cameron Joyce & Co., Keokuk, Ia., 0.423 mi. Alexandria to Wayland Rd. **F.A.P.** 171A, $13,-123; 0.99 mi. F.A.P. 172B, $34,356; 2.484 mi. F.A.P. 171C, $198,374; 4.398 mi. F.A.P. 171B, $136,571, all foregoing Clark Co. Grand total $384,424. Bids Oct. 11. Noted Oct. 18, C. D.

Missouri — State Hy. Dpt., Jefferson City, grading and graveling 3.541 mi. Pulaski Co., to Amyx Bros., West Plains, $9,303***4.327 mi. Clay Co. and 4.234 mi. in Clay Co., to Hoover Bros., 2715 East 15th St., Kansas City, $26,826 and $38,201 respectively***1.983 mi. Jackson Co., to M. E. Gillioz, Monett, $57,007***2.154 mi. Ste. Genevieve Co., to F. T. O'Dell Constr. Co., Hannibal, $15,604***1.117 mi. Christian Co., to Garrett Constr. Co., Springfield, $18,326. Grand total $165,267. Rejected bids Nov. 22, improving roads in Nodaway and Jefferson Counties. Bids Dec. 22. Noted Nov. 21, C. D.

Neb., Hebron — City, grading, curbing, paving roads, to Roberts Constr. Co., Lincoln, $75,1[illegible]. Est. $100,000. Bids Dec. 13. Noted Dec. 5, C. D.

Neb., Hopper—City, concrete paving 20,405 sq.yd. roads, to Schoeman & Clark, Sioux City, Ia., $43,819. Est. $50,000. **P.W.A.** Bids Dec. 13. Noted Dec. 10, C. D.

Neb., Humphrey—City, concrete paving 21,-430 sq.yd. streets, to Schoenman & Clark, Sioux City, Ia., $49,317. Est. $50,000. **P.W.A.** Bids Dec. 14. Noted Dec. 10, C. D.

Nevada—State Hy. Comn., Carson City, to Nevada Rock & Sand Co., Reno, grading, draining, crushed graveling 5.2 mi. road in Lyon Co., $180,004***to Pacific Constr. Co., San Francisco, Calif., 2.5 mi. road Clark Co., $83,-860; 0.9 mi. White Pine Co., $48,505; 8.3 mi. road Clark Co., $82,603. Grand total $394,971. Bids Dec. 13.

Nevada—State Hy. Comn., Carson City, to Pacific Constr. Co., 334 Stockton St., San Francisco, constructing 2.5 mi. state highway in Las Vegas, Clark Co., $83,860; 8.3 mi. road from point 8 mi. south of R. R. Pass and R. R. Pass, Clark Co., $82,605; 0.88 mi. in Ely, White Pine Co., $48,510***to Nevada Rock & Sand Co., 949 East 4th St., Reno, 5.19 mi. road between Virginia City and Silver City, Storey and Lyon Counties, $180,005. Grand total $394,980.

★ **New Mexico** — State Hy. Dpt., Sante Fe, improving roads in Quay Co., to A. O. Peabody, Las Cruces, $267,460 est. $310,079***road FLH 5-A and WPSS, Eddy Co., to Dudley Stone Products Co., 2101 San Diego St., El Paso, Tex., $80,360 and $92,598 respectively est. $98,671 and $112,769 respectively***road in Santa Rosa, to Ernest Everly, Albuquerque, $26,819 est. $33,285***road in Torrance Co., to Wheeler & Silver, Albuquerque, $22,399 est. $24,001***road in Hidalgo Co., to Brown Bros., Albuquerque, $52,565 est. $66,606. Grand total $542,201. **P.W.A.** Noted Dec. 11, C. D.

New Mexico—State Hy. Dpt., Santa Fe, improving roads in Otero Co., to Brown Bros., Albuquerque, $47,473 est. $64,113***Catron Co., to E. Everly, Albuquerque, $109,168 est. $91,078***Quay Co., to R. L. Hanes, Albuquerque, $41,953 est. $52,831***Guadalupe Co., to W. E. Bondurant, Roswell, $32,974 est. $40,-947***Valencia Co., to L. R. Allison, Albuquerque, $33,852 est. $31,580***Chaves Co., to Armstrong & Armstrong, Roswell, $178,700 est. $178,927. Grand total $444,120. **P.W.A.** Bids Dec. 21. Noted Dec. 11, C. D.

★ **New York**—Dpt. P. Wks., Albany, improving 2.1 mi. road in St. Lawrence Co., to Hogeboom-Campfield, Inc., Utica, $33,185 est. $42,076***1.49 mi. Albany Co., to Sheehan Contg. Corp. 445 2nd St., Albany, $173,973 est. $183,433***.8 mi. Broome Co., to Binghamton Concrete Co., Inc., Marine Midland Bldg., Binghamton, $373,139 est. $449,300***0.66 mi. Cattaraugus Co., to J. M. Murray, Cutler Bldg., Rochester, $37,560 est. $44,059***4.16 mi. Ulster Co., to Lane Constr. Co., 35 Colony St., Meriden, Conn., $225,221 est. $262,-564***bridges Chenango Co., to B. Trumbull, Schenectady, $54,278. Grand total $919,139. Improving 0.78 mi. Genesee and Clark Sts., Auburn, Cayuga Co., from Stento Paving Co., Binghamton, $46,571. Rejected bids Dec. 17, roads in Lewis Co. Bids Dec. 17. Noted Dec. 2, C. D.—Dec. 5, E. N.-R.

N. Y., New York—J. J. Lyon, pres. Bronx Boro, Bronx County Bldg., grading West Bedford Blvd., to Bronx Asphalt Corp., 900 Zerega Ave., $180,080***Boone Ave., to Alice Constr. Co., 3419 Giles Pl., $4,701***curbing Bronx Ave., to A. Musumecci, 277 East 146th St., $1,229***East 164th St., to F. Mascali & Sons, 645 Tremont Ave., $8,738. Grand total $197,-748. Bids Dec. 10. Noted Dec. 11, C. D.—Dec. 5, E. N.-R.

North Carolina — State Hy. Dpt., Raleigh, grading, sand clay surfacing 7.31 mi. Project 1395, Halifax Co., to E. W. Grannis, Fayetteville, $45,508. Noted Dec. 11, C. D.—Dec. 18, E. N.-R.

North Dakota—State Hy. Comn., Bismarck, grading 10.193 mi. Golden Valley Co. and 8.43 mi. McKenzie Co., to M. B. Monson, Bismarck, $65,180 and $68,198 respectively. Bids Dec. 3. Noted Nov. 15, C. D.—Nov. 21, E. N.-R.

O., Cincinnati—City, widening from 36 to 40 ft., water and necessary sewers, oil asphalt on 7 in. concrete paving 4,000 sq.yd. Twelfth St., to Scully Bros., Atlas Bank Bldg., $18,378 est. $20,240***grading, drainage, curbs, walks and 7 in. rein.-con. paving 3,460 sq.yd. Temple Ave., to Murdock Constr. Co., 4701 Montgomery St., Norwood, $20,253 est. $23,046***grading, curbing, sewer and 8 in. rein.-con. paving 4,210 sq.yd. Robert Ave., and grading, sewers 9 in. rein.-con. paving 9,580 sq.yd. Forest Ave., to A. J. Henkle Constr. Co., Bell Block, $22,949 and $49,011 respectively, est. $23,484 and $53,-621 respectively. Grand total $110,591. **P.W.A.** Noted Dec. 12, C. D.—Dec. 19, E. N.-R.

Pennsylvania — Dpt. Hys., Harrisburg, dual type paving 1.9 mi. Route 139 Spur, Swatara Twp. and city of Harrisburg, Dauphin Co., to Harry P. Campbell Sons, Towson, Md., $118,-903. Bids Dec. 6.

Pennsylvania—Dpt. Hys., Harrisburg, rein.-con. paving 2.27 mi. Route 176, Sects. 2A and 2B, White Deer and Gregg Twps., Union Co., to H. S. Shafer Constr. Co., 115 North New St., Nazareth, $64,364. Bids Dec. 16.

S. C., Greenville—Greenville Co. Bd., bituminous surfacing county roads, to E. D. Sloan, Greenville, $127,772; drainage structures, to M. J. Carroll, Macon, Ga., $41,826. **P.W.A.** Noted Dec. 5, C. D.

S. C., Pickens—T. R. O'Dell, Rd. Superv. Pickens Co., Court House, bituminous surfacing 63 mi. highways 17 ft., to R. B. Tyler Co., Louisville, Ky., $138,882. **P.W.A.** Noted Dec. 3, C. D.—Dec. 5, E. N.-R.

Texas—G. Gilchrist, state hy. engr., Austin, caliche and limestone base courses 16.106 mi. State Hy. 75, F.A.P. 547-B, G. C and A, and 517-G, F and E, Gray and Donley Counties, 90 cu.yd. unclassified structural, 51,480 cu.yd. common and 7,200 cu.yd. special road excav., to Field Bros., 312 Myrick Bldg., Lubbock, $111,375. Est. $120,000. Bids Nov. 19. Noted Nov. 25, C. D.

Texas—G. Gilchrist, state hy. engr., Austin, grading, drainage structures 6.492 mi. State Hy. 21, Control 118-10-4, San Augustine Co., to R. B. Smith, San Antonio, $151,380 est. $160,000***concrete paving 4.95 mi. State Hy. 1, Control 10-3-7, Morris Co., to Harrison Eng. & Constr. Corp., Fairfax Bldg., Kansas City, Mo., $121,258 est. $120,000***bituminous on crushed gravel surfacing 8.818 mi. State Hy. 2, Contr. 16-2-9, Hays Co., to W. W. Vann, Kerrville, $38,531 est. $40,000. Grand total $311,169. Bids Dec. 3. Noted Dec. 16, C. D.

★ **Texas**—G. Gilchrist, state hy. engr., Austin, caliche base course and triple asphalt surface treatment 10.993 mi. Irion Co., to E. F. Bucy & C. T. Childs, Rising Star, $83,167 est. $80,000***grading, small drainage structures 8.541 mi. Fort Bend and Waller Counties, to J. F. Buckner, Cleburne, $18,042 est. $20,000***4.289 mi. and 4.001 mi. Bexar Co., to R. W. Briggs & Co., Pharr, $89,971 and $51,261 respectively, est. $80,000 and $50,000 respectively***3.658 mi. Parker Co., to J. W. Abbott Constr. Co., 2809 Lipscomb St., Ft. Worth, $65,215 est. $40,000***6.159 mi. Newton Co. and iron ore top soil base course and road oil surface treatment 7.938 mi. Harrison Co., to Brown & Root, Inc., Colorado St., Austin, $115,-506 and $71,023, respectively, est. $110,000 and $80,000 respectively***6.595 mi. and 8.507 mi. Dawson Co., also 4.914 mi. Menard Co., to Hannah & Hall, Professional Bldg., Waco, $44,-198 and $44,924 respectively, est. $40,000 each***8.632 mi. Harrison Co., to Reynolds & Sutton, Tyler, $117,640 est. $120,000***6.182 mi. Montague Co., to Capital Constr. Co., 4212 Avenue D, Austin, $100,829 est. $100,000***4.3 mi. Stonewall Co., to W. S. Crawford & E. T. Prater, 4123 Avondale St., Dallas, $31,251 est. $30,000***resectioning, lengthening, drainage structures and widening pavement 7.05 mi. Grayson Co., to McCall Eng. Co., Amicable Bldg., Waco, $79,987 est. $80,000***caliche blanket course, sludge stone and waterbound broken stone macadam base course and triple asphalt

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†*Federal Government.*

Streets and Roads (Continued)

surface treatment 7.351 mi. McLennon Co., to Cage Bros., Bishop, $108,174 est. $100,000*** caliche and sandstone base course, 16.418 mi. Webb Co., to H. B. Zachary, Laredo, $89,747 est. $80,000. Grand total $1,130,920. Bids Nov. 19. New P.W.A. Noted Nov. 25, C. D.

★ **Texas**—G. Gilchrist, state hy. engr., Austin, concrete paving 9.917 mi. State Hys. 9 and 66, F.A.P. 239-U-2, 193-U-2 and 166 U-2, Bexar and Atascosa Counties, to H. B. Zachary, Laredo, $208,860 est. $225,000***5.77 mi. State Hy. 6, F.A.P. 98-B, Collin Co., to Central Bitulithic Co., West Commerce St., Dallas, $122,019 est. $120,000***grading, drainage structures, concrete paving 6.647 mi. State Hy. 6, F.A.P. 98-A, Contr. 1, and 4.552 mi. State Hy. 6, F.A.P. 98-A, Contr. 2, both Collin Co., to Harrison Eng. & Constr. Corp., Fairfax Bldg., Kansas City, Mo., $201,308 and $129,117 respectively, est. $200,000 and $140,000 respectively***grading, drainage structures 4.023 mi. State Hy. 1, F.A.P. 28-B, Morris Co., to J. Lee & E. A. Vilbig, 2517 Eakin St., Dallas, $40,625 est. $40,000. Grand total $701,929. Bids Dec. 3. New P.W.A. project. Noted Dec. 11, C. D.

Wash., Everett—City, widening and resurfacing 16th St. from Rockefeller to Walnut Sts., to E. J. Templeton & Co., 2924 Lombard St., $26,538 Est. $35,914. Bids Dec. 9. Noted Dec. 16, C. D.—Dec. 19, E. N.-R.

Wash., Vancouver—Clark Co., clearing, grading, grubbing 2.88 mi. Mill Plain Rd. and regrading and widening 24 ft. and draining, surfacing 18 ft. wide 2.77 mi. Jaggy Rd., to Klineline, Varn & Johnson, Vancouver, $17,398 and $19,958 respectively. P.W.A.

Wash., Yakima—Yakima Co., resurfacing 8½ mi. Mabton-Grandview Rd., to Joslin & McAllister, East 3038 Trent Ave., $34,443*** paving 2 mi. West Wapato Rd., to J. H. Collins & Co., South 1924 Post St., Spokane, $56,745***grading, surfacing 4.7 mi. Tieton Drive and 4.7 mi. Wiley Heights Rd., to Redmon Turner Co., 304 South Fourth St., $32,851 and $30,204 respectively. Grand total $154,243. Noted Dec. 18, C. D.—Dec. 26, E. N.-R.

★ **Wisconsin**—State Hy. Comn., Madison, grading, draining, concrete paving 1.991 mi. Winnebago Co., to Lampert & Lampert, Inc., 1055 Bowen St., Oshkosh, $51,597***4.95 mi. Door Co., to Daanen & Janssen, 202 South Erie St., DePere, $12,490***6.166 mi. Rock Co., to R. R. Birdsall & Sons Co., 1025 12th St., Racine, $64,913***3.95 mi. Door Co., to Dixon Constr. Co., Albany, $30,510***0.784 mi. Marathon Co., to Burch Constr. Co., 119 East Washington Ave., Madison, $5,173***5.066 mi. in Oneida and Vilas Counties, to H. S. Kaliher, Washburn, $40,574***5.181 mi. Ashland Co., to W. L. Kimmes, 1716 56th St., Superior, $81,121***0.262 mi. in Lafayette and Iowa Counties, to H. Raemisch, Dane, $5,215***5.693 mi. Iowa Co., to Interstate Constr. Co., Cobb, $95,382***structures and grading 0.53 mi. road in Lafayette Co., to Legreid Constr. Co., Stoughton, $21,030. Grand total $408,005. Bids Dec. 20. Noted Dec. 9, C. D.—Dec. 12, E. N.-R.

Wisconsin—State Hy. Comn., Clark and Dunn Counties, Eau Claire, concrete paving 7.25 mi. roads in Clark Co., to Morris Martin Co., Berlin, $148,155***grading, draining, graveling 4.18 mi. Dunn Co., to F. Mashuda, Milwaukee, $48,588***one 12x10 ft., rein.-con. box culvert in Dunn Co., to Hoeppner & Bartlett, Eau Claire, $12,157. Grand total $208,900. Bids Dec. 17. Noted Dec. 9, C. D.—Dec. 12, E. N.-R.

Ont., London—See "Sewerage and Waste Disposal."

EARTHWORK, IRRIGATION DRAINAGE AND WATERWAYS

PROPOSED WORK

Calif., San Francisco—City and San Francisco Co. making plans extending Mills Field Airport in navigable waters to construct seaplane channel. To exceed $25,000. Engineering Dpt. of P. Utilities Comn., 425 Mason St., engrs. Construction pending authorization of U. S. War Dpt.

Neb., Omaha—City, City Hall, making plans straightening and widening Saddle Creek, south of Centre St. To exceed $25,000. H. Trustin, mgr. Will submit plan to W.P.A.

N. J., Camden — City plans constructing masonry dam, dikes and creation of 78 acre lake for recreational purposes, $70,568. W.P.A. project. R. G. Haaf, Broadway and Royden St., W.P.A. engr.

Okla., Enid—Drainage Dist. 1 making preliminary plans and surveys for drainage Dist. 1, Garfield Co. $45,000. F. W. Denner, Enid, engr.

BIDS ASKED

Minn., Crookston—See "Contracts Awarded."

Que., Petite Riviere East—Jan. 9, by Secretary, Dpt. P. Wks., Ottawa, Ont., constructing fishing harbor consisting of extension to breakwater and repairs to dolphin, 6,000 lin.ft. creosoted piles, 2,700 ft. B.M. creosoted timbers. $20,000. K. M. Cameron, Ottawa, Ont., engr.

LOW BIDDERS

★ †**N. M., Fort Sumner**—Bureau Reclamation, Dpt. Interior, Carlsbad, Dec. 21, construct-

†*Federal Government.*

Alamogordo Dam, Carlsbad Project, near here, from Hallett Constr. Co., Crosby, Minn., $1,132,547. Noted Dec. 5, C. D.

CONTRACTS AWARDED

Idaho, Bonners Ferry—Drainage Dists. 4, 7, 6, 13, 8, 12, 9 and 10, Kootenai Village Drainage Dists., Boundary Co., diking and drains, to Morrison-Knudsen Co., Boise, Idaho, $147,165. G. C. McGeen, Bonners Ferry, engr.

Minn., Crookston—Polk Co., H. J. Welte, co. aud., constructing lake off river and bath houses, incl. damming Red Lake River, 5 mi. east of here, clearing lands and river bottom, erecting 2 bath houses, by W.P.A. labor. $25,000. C. Beck, Crookston, county maintenance supt.

N. Y., Sloan — Village, R. Kierstein, clk., rein.-con. flume for regulation of Little Buffalo Creek (3,000 ft.), to E. Cerullo, 80 Main St., Depew, $54,433. Est. $92,727. P.W.A.

N. D., Towner—McHenry Co., c/o McHenry Co. Flood Irrigation Bd., E. W. Olsen, co. aud., constructing dam across Mouse River, 4 mi. west of here, incl. steel sheet piling, to Megarry Bros., Bismarck, $46,303. Bids Dec. 11. E. J. Thomas, acting engr.

†**Tenn., Knoxville**—Tennessee Valley Authority, Knoxville, structural steel handrail for roadway across Wheeler Dam, to Blaw Knox Co., Blawnox Bldg., Pittsburgh, Pa., $29,935.

†**Tenn., Knoxville**—Tennessee Valley Authority, Knoxville, constructing lock gates at Pickwick Landing Lock, to Virginia Bridge & Iron Co., $167,000***to Nashville Bridge Co., foot of Shelby Ave., Nashville, $12,000***and to Lakeside Bridge Co., 3200 West Villard Ave., Milwaukee, Wis., $8,000. Grand total $187,000. Noted Nov. 22, C. D.—Nov. 28, E. N.-R.

Wyoming—Greybull Valley Irrigation Dist., constructing 8 mi. canal to divert water from Greybull River, to Taggart Constr. Co., Cody, $104,676. Noted Feb. 28, C. D.—Mar. 7, E. N.-R.

Que., Riviere du Loup—Dpt. P. Wks., Ottawa, Ont., dredging, to Gaeardo Constr. Co., Ltd., Quebec City, $21,470. K. M. Cameron, Ottawa, Ont., engr.

UNCLASSIFIED

PROPOSED WORK

California — GAS PIPE LINE — Southern California Gas Co., 950 South Bway., Los Angeles, plans 9½ mi. gas pipe line from Semitropic gas field to Los Angeles, main trunk line and 25 mi. line from Kettleman Hills to Fresno and Visalia, former line of 10 and 12 in. pipe and latter line of 6, 8 and 10 in. pipe, in Kern, Tulare and Fresno Counties. Private plans.

Mich., Detroit—TUNNEL, etc.—Murray Corp. of America, 1424 Aberle St., plans by Giffels & Vallet ,archts. and engrs., 1000 Marquette Bldg., tunnel and bridge. To exceed $17,000.

N. J., Camden—LAKE, etc.—See "Earthwork, Irrigation, Drainage and Waterways."

N. J., Camden — SWIMMING POOL — City, City Hall, plans reconstructing swimming pool and sidewalks and spillway. $3,124. W.P.A. project. R. G. Haaf, Broadway and Royden Sts., W.P.A. engr.

★ **N. J., Jersey City**—DOCKS, etc.—Foreign-Trade Zone Associates, 74 Trinity Pl., New York, plans docks and terminals on 1,000 acre site at Greenville Sect. $50,000,000. Maturity indefinite. Dependent upon securing New Jersey and Federal Charters stablishing a free port of entry at this point.

N. J., Jersey City—HIGH SCHOOL FIELD—City, City Hall, plans constructing high school field, Montgomery and Florence Sts., demolition of present wood stand, enlarging area, constructing steel stand with fence enclosure. $170,953. W.P.A. project. F. W. Brannagan, 240 Washington St., W.P.A. engr.

Tex., San Antonio—LAKE IMPROVEMENTS, etc.—City, C. K. Quin, mayor, plans Woodlawn Lake improvements, rock municipal concession building, concrete sidewalks, tennis courts, landscaping on 35 acres land, opening and straightening channel, lighthouse, 2 small bridges, rebuilding 42 in. drain. Purchasing materials at once. $99,993 W.P.A. funds, $5,721 supplied by city.

Ont., Glencoe—GAS DISTRIBUTION MAINS —Election Jan. 6, to vote on reconstruction mains for gas distribution.

★ **Sask., Fort a la Corne**—HYDRO-ELECTRIC DEVELOPMENT — Dominion Govt. making plans constructing hydro-electric development on Saskatchewan River. $15,000,000. Maturity in spring.

BIDS ASKED

Mich., Detroit — BEACON LIGHT — Jan. 7, by E. H. Bauer, acting secy. Detroit Dpt. Water Supply, furnishing, erecting automatic flashing beacon light to mark end of intake lagoon, head of Belle Isle, Detroit River, 15 beam candlepower flashing beacon light with steel tank house and tower on concrete pier at head of Belle Isle. P.W.A. Contr. RC28. G. H. Fenkell, 735 Randolph St., engr.

Mississippi—TURPENTINE and PITCH EXTRACTION—See "Contracts Awarded."

New York—SUBWAY DRAINAGE—Jan. 14, by Bd. Transportation, J. H. Delaney, chn., 250 Hudson St., New York, furnishing, installing drainage equipment for Line D from Roosevelt Ave. to 178th St., Queens Boro and Line E, from Fulton St. to Nassau Ave., Brooklyn Boro.

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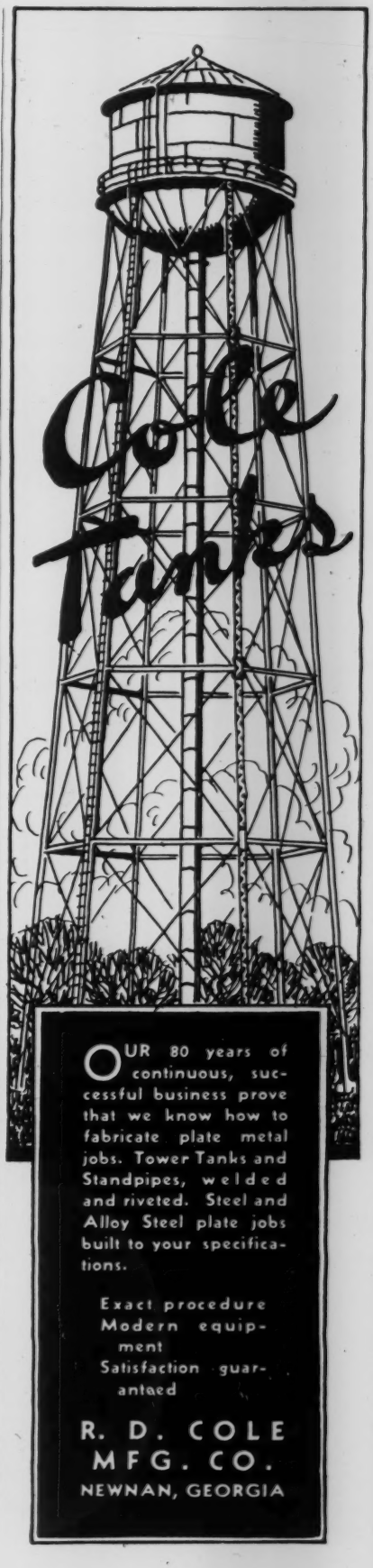
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Unclassified (Continued)

Man., Winnipeg Beach—HARBOR FACILITIES —See "Contracts Awarded."

CONTRACTS AWARDED

†**D. C., Wash.** — FIELD HOUSE — National Park Service, constructing swimming pool and altering field house in East Potomac Park, to Charles H. Tompkins, 1630 Connecticut Ave., $84,840.

Mississippi—TURPENTINE and PITCH EXTRACTION—Southern Naval Stores Co., Columbia, turpentine and pitch extraction from stumps in undisclosed location, Marion Co., separate contracts. Est. $28,000 with equipment.

Mo., St. Louis—COMFORT STATIONS—H. Kissel's Sons, general contractors, 4107 West Florissant Ave., excavating for 25 comfort stations, to Krummel & Jansen, 5976 Southwest St.***dampproofing, to Trinidad Asphalt Mfg. Co., 600 South Theresa St.***granitoid and foundation work, to H. A. Dailey Contg. Co., 4108 Clayton St.***rubble masonry and cut stone work, to A. DeBenedetty, 3300 Lucas and Hunt Rd.***brick work, to A. Meinnoltz, 4174 North Euclid St.***iron and steel work, to Spuck Iron & Fdry. Co., 3145 North 14th St.***painting, to J. Ward, 3110 Easton St. ***plumbing and heating, to T. J. Sheehan Co., 2233 Olive St.***electrical work, to Richardson Electric Co.***hardware, to Melcher-Schene Hardware Co., 4800 Natural Bridge. **P.W.A.** Noted Dec. 16, C. D.—Dec. 19, E. N.-R., under "Contracts Awarded."

New York—TUNNEL—Port of New York Authority, 111 8th Ave., New York, making land borings in Weehawken Twp., N. J., for approach to Midtown Hudson Tunnel, to Sprague & Henwood, Inc., 11 West 42nd St., New York, $8,027. **P.W.A.** Bids Dec. 12. Noted Dec. 13, C. D.

O., New Baltimore—CAMP DEVELOPMENT —Catholic Charities, 7th and Main Sts., constructing camp, all buildings 1 story, basement, frame, 3 baseball diamonds, kitchen, 26x27 ft., cold storage, 15x48 ft., 1 tennis court, director's cottage, 22x90 ft., dining hall, 26x72 ft., sixteen 10x15 ft., brick houses, lodge, 16x54 ft., director's building, 15x34 ft., infirmary, 13x35 ft., classroom house, 50x70 ft., swimming pool, 40x100 ft., to E. Honner, Mt. Healthy. Awarded Dec. 18.

Okla., Oklahoma City — GREENHOUSE — School Bd., general contract 1 story greenhouse at Stonewall Jackson High School, Villa St., to C. Moreau, Huckins Hotel, $47,331. **P.W.A.** Awarded Dec. 15. W. T. Valberg, 1222 North Bway., archt.

Pennsylvania-New Jersey—HIGH SPEED LINE SUPPLIES—Delaware River Joint Comn., Bridge Plaza, Camden, N. J., furnishing miscellaneous supplies for Delaware River Bridge high speed line, to Kaufman Constr. Co., 1505 Race St., Phila., Pa., $47,320.

Pa., Pittsburgh — AIRPORT HEATING PLANT—R. G. Woodside, controller Allegheny Co., general contract, central steam heating plant, Allegheny County Municipal Airport, to Tri-Borough Supply Co., Greensburg Ave., Turtle Creek, $47,400***equipment, to Erie City Iron Wks., Erie, $21,740***electrical work, to Daniels Electric Co., Center Ave., $1,360; piping, to National Valve & Mfg. Co., 3101 Liberty Ave., $9,186***plumbing, to Weldon & Kelly Co., 1801 Locust St., $1,695. Grand total $81,381. **P.W.A.** Noted Dec. 5, C. D.

Man., Winnipeg Beach—HARBOR FACILITIES Dpt. P. Wks., Ottawa, Ont., enlarging harbor facilities, day labor. Est. $25,000. K. M. Cameron, Ottawa, Ont., engr.

MATERIALS AND EQUIPMENT

PROPOSED WORK

AIR COMPRESSOR — **Anna, Ill.** — Dpt. P. Wks. & Buildings, Springfield, rejected bids Oct. 8, for air compressor.

BIDS ASKED

†RIP RAP STONE—**Sacramento, Calif.**—U. S. Eng., New Post Office Bldg., Sacramento, taking bids 2,000 tons rip rap stone, delivered by barge or truck along east bank of Sacramento River above Colusa Weir.

†STEEL, etc.—**Wash., D. C.**—Jan. 8, by General Purchasing Officer Panama Canal, Wash., D. C., steel, steel billets, boiler tubes, welded steel pipe, c.i. pipe, clay pipe, pipe fittings, railing fittings, calcium chloride, valves for Panama Canal, Schedule 3113.

CEMENT, etc.—**Austin, Minn.**—Jan. 8, by C. M. Hubbard, aud. Mower Co., furnishing 2,830 bbl. cement and 58,400 lb. reinforcing steel for bridge construction.

†ELECTRIC CABLE—**Brooklyn, N. Y.**—Jan. 7, by Yards & Docks, Navy Dpt., Wash., D. C., 35,000 lin.ft. electric cable for Brooklyn Navy Yard.

CONTRACTS AWARDED

†PIPE, etc.—**Mobile, Ala.**—U. S. Eng., Mobile, 3,000 ft. c.i. pipe and fittings, to Central Fdry. Co., Bessemer, Ala., $1,992.

PIPE—**Reading, Mass.**—Town, H. W. Putnam, chn. Bd. P. Wks., Town Hall, furnishing 12 in. c.i. water pipe, to Warren Pipe Co. of Mass., 75 Federal St., Boston at $1.81 per ft. **P.W.A.** Bids Dec. 6.

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STEEL TANK—**Schenectady, N. Y.**—P. E. Van DeMark, 1411 State St., will purchase steel tank for gasoline service station, 1411 State St. Construction contract awarded to A. C. Rowe, 341 Delaware Ave., Delmar. To erect $1,000.

PIPE—**Eugene, Ore.**—Water Bd., about 300 tons 8- to 20-in. c.i. pipe, to U. S. Pipe & Fdry. Co. Burlington, N. J., about $24,000

†BATTERY CHARGING SETS — **Knoxville, Tenn.**—Tennessee Valley Authority, Knoxville, 4 control battery charging sets, to Electric Products Co., 1725 Clarkstone Rd., Cleveland, O., $5,340. Bids Nov. 19. Noted Oct. 30, C. D. —Nov. 7, E. N.-R.

†CONCRETE MIXERS—**Knoxville, Tenn.** — Tennessee Valley Authority, Knoxville, concrete mixers, to Ransome Concrete Mchy. Co., Dunellen, N. J., $3,900. Bids Dec. 2. Noted Nov. 22, C. D.—Nov. 28, E. N.-R.

†DRUM GATES—**Knoxville, Tenn.**—Tennessee Valley Authority, Knoxville, drum gates to Virginia Bridge & Iron Wks., Roanoke, Va., $107,000. Bids Oct. 16. Noted Sept. 26, C. D. —Oct. 3, E. N.-R.

†CONTROL VALVES — **Knoxville, Tenn.** — Tennessee Valley Authority, Knoxville, control valves, to Koppers Constr. Co., Koppers Bldg., Pittsburgh, Pa., $3,450. Bids Oct. 23. Noted Oct. 22, C. D.

†CRANES — **Knoxville, Tenn** — Tennessee Valley Authority, Knoxville, 2 cranes for Wheeler Power Plant, to Alliance Mchy. Co., $88,000. Bids Oct. 22. Noted Oct. 7, C. D.—Oct. 10, E. N.-R.

†MECHANICAL EQUIPMENT — **Knoxville, Tenn.**—Tennessee Valley Authority, Knoxville, mechanical and conveying equipment at Pickwick Landing Dam, to Barber Green Co., 512 West Park Ave., Aurora, Ill., $16,500; and to Goodrich Belting Co., $8,000. Bids Nov. 1. Noted Oct. 22, C. D.—Oct. 24, E. N.-R.

†METAL PARTS, etc. — **Knoxville, Tenn.** — Tennessee Valley Authority, Knoxville, miscellaneous metal parts, temporary gates, Pickwick Landing Dam, to Stacy-Schmit, York, Pa., $5,000. Bids Oct. 14. Noted Sept. 26, C. D.

CAST IRON PIPE—**Seattle, Wash.**—City, furnishing 2,328 ft 6- to 16-in. c.i. water pipe, to H. G. Purcell, Colman Bldg., $5,105. Awarded Dec. 12. Noted Nov. 4, C. D.—Nov. 7, E. N.-R.

†GALVANIZED WIRE, etc. — **Milwaukee, Wis.**—Forest Service, galvanized wire, to J. A. Roebling Sons Co., 540 South Broad St., Trenton, N. J., $1,567***paint, to **Jewel** Paint & Varnish Co., 345 Northwestern Ave., Chicago, Ill., $455***snow plows, to **Nagle Hart** Trust Co., 2015 West St. Paul Ave., $2,261***anvils, to J. Pritzloff Hardware Co., 333 North Plankington Ave., $224***7,670 lb. wire, to Keystone Steel & Wire Co., Peoria, Ill., $439. Grand total $4,946.

CONCRETE PIPE—**West Allis, Wis.**—City, to Consumers Supply Co., 4135 West State St., Milwaukee, 156 ft. 15 in. concrete pipe at 73c. per ft.; 220 ft. 12 in. 42c.; 117 ft. 18 in. $1; 118 ft. 27 in. $2.40; 190 ft. 30 in. $2.90***to Schneider Fuel & Supply Co., 3438 West Forest Home Ave., Milwaukee, 270 ft. 24 in. at $1.90; 205 ft. 39 in. $4.30***to Waukesha Cement Tile Co., Waukesha, 335 ft. 36 in. $3.90. Bids Dec. 7.

FOREIGN

Egypt, Cairo—Jan. 25, by Mechanical & Electrical Director, Ministry of Public Works, supplying and erecting flue dust collector plant at Aft Station.

England — Hertford Co. Council, **Hertford**, plans by Jarvis & Baywater, 5 Bloomsbury St., London, constructing new county offices, $669,985 available***Royal East Sussex Hospital Governors, **Hastings**, plans by Callow & Callow, 47 Havelock Rd., constructing pathological building and theatre unit, $600,000***Boston Town Council votes for constructing 252 houses, $534,000***Rochdale Town Council making plans 232 house construction roads, sewers in housing scheme, $600,000***Bristol City Council voted $1,665,000 constructing new Western Rd.***R. F. Barthley, Way Manor, prepares plans erecting 378 houses, **Chertsey**, $720,000 ***Ashford Urban Council plans new council building, $500,000***London. E. A. S. Bell, managing dir. South Indian Railway, 91 Petty France, Westminister, in market for supply of M.S. section bars, etc.

New Zealand, Wellington—Feb. 4, by Secretary Public Wks., Supplies & Tenders Com., for 50 kv. switchgear and steel work and controlling equipment.

Siam, Bangkok—Royal Siamese State Railways in market for 7,000 metric tons steel rail and accessories.

South Africa, Kimberley—Jan. 27, by Municipal Clerk, supplying complete abattoir and cold storage plant.

Union Socialist Soviet Republics—Soviet Government, c/o Amtorg Trading Corp., 261 5th Ave., New York, constructing radio machinery and equipment, to Radio Corp. of America, 30 Rockefeller Plaza, New York, $2,000,000.

Wales—Maesteg City, plans approved sewerage scheme, $1,625,000, Capt. Goeffry, Crawshay, special comn.***Blaenavon** City, plans approved sewerage and drainage scheme, $1,300,000.

†*Federal Government*

PUBLIC BUILDINGS

PROPOSED WORK

N. Y., Andes—Bd. Educ., Central School Dist., withdrew bids to have been opened Dec. 18, constructing school. $142,500. P.W.A. project. H. O. Fullerton, 152 Washington Ave., Albany, archt. Noted Dec. 10, C. D.—Dec. 12, E. N.-R.

N. D., Grand Forks—City received no bids Dec. 11, constructing power plant, distribution system and equipment. $472,000. P.W.A. project. E. L. Lium, city engr. Burns & McDonnell, West Linwood Blvd., Kansas City, Mo., consult. engrs. Noted Dec. 2, C. D.—Dec. 5, E. N.-R.

★ **O., Toledo**—Bd. Educ. plans by E. Gee, new high school, part of Belmont Ave. Housing Project. $900,000.

Pa., Franklin—Franklin School Dist., W. O. Phipps, pres., plans by Lawrie & Green, 3rd and Forster Sts., Harrisburg, constructing new Junior High School building and improvements to Senior High School. $293,182. P.W.A. approved loan of $142,000 and grant of $116,182. Noted Mar. 15, C. D.—Mar. 21, E. N.-R.

BIDS ASKED

Ill., Aurora—Jan. 8, by School Dist. 131 of Aurora, Kane Co., constructing 3 story, 70x126 ft., brick, concrete, stone high school addition. $150,000. $42,000 P.W.A. grant. J. C. Lewellyn Co., 38 South Dearborn St., Chicago, archts. Noted Sept. 25, C. D.—Oct. 3, E. N.-R.

†**Fla., Miami**—Jan. 6, at office Sup. Archt. Treas. Dpt., Wash., D. C., constructing U. S. Coast Guard Air Station. $102,000.

★ **Ind., Indianapolis**—Feb. 4, by Treas. Dpt., at office Sup. Archt., Wash., D. C. constructing 5 story, basement, 100x341 ft. U. S. Post Office and federal building addition, New York St., between Meridian and Penn St., $1,300,000. McQuire & Shook, 1401 Fletcher Trust Bldg., archts. Rankin & Kellogg, Architects Bldg., Phila., Pa., consult. archts.

Minn., Bemidji—Jan. 7, by Bd. Educ., C. L. Pegelow, clk., constructing 2 story, basement, rein.-con., brick, stone, school addition, $100,000 up. P.W.A. project. Broaten & Foss, Fergus Falls, archts.

Minn., Glenwood—Jan. 7, by Bd. Educ., general contract 3 story, basement, brick, cut-stone school. $190,000. P.W.A. project. N. W. Fisher, St. Mary's Bldg., St. Cloud, archt. Noted Dec. 9, C. D.—Dec. 12, E. N.-R., under "Contracts Awarded."

N. J., Teaneck—See "Contracts Awarded."

N. Y., Binghamton—See "Contracts Awarded."

N. Y., Brooklyn—Jan. 10, by W. A. Martin, archt. and supt. School Buildings, Flatbush Ave. extension and Concord St., Brooklyn, constructing P. S. 234, East 17th St. and Avenue X, for Bd. Educ., 500 Park Ave., New York.

N. Y., Buffalo—See "Contracts Awarded."

N. Y., East Elmhurst—Jan. 10, by W. A. Martin, archt. and sup. School Buildings, Flatbush Ave. extension and Concord St., Brooklyn, constructing P. S. 127 addition, 25th Ave., 98th and 99th Sts., Queens Boro, for Bd. Educ., 500 Park Ave., New York.

Minn., Minneapolis—Jan. 10, by State Commission Administration & Finance, 120 State Capitol, St. Paul, general contract 4th story addition to 100x192 ft. hospital, at University of Minnesota campus. $200,000. P.W.A. project. C. H. Johnston, 360 Robert St., St. Paul, archt. Noted Oct. 10, C. D.—Oct. 17, E. N.-R.

LOW BIDDERS

★ **Okla., Oklahoma City**—City, Dec. 9, constructing 2 story, 282x300 ft., brick steel municipal auditorium, plain found., Walker St., from W. S. Bellows Co., Oklahoma Savings & Loan Bldg., $1,042,565. P.W.A. project. Noted Dec. 4, C. D.—Nov. 21, E. N.-R.

★ **Tex., Austin**—State Bd. Control, Dec. 19, general contract for state hall at Centennial Exposition, from P. O. Montgomery, 3137 Knox St., Dallas, for completion in 5½ months, $1,008,000 and in eight months $993,000.

CONTRACTS AWARDED

†**Ala., Fort McClellan**—Con. Q. M., constructing 1 story, 84x123 ft. post exchange, to Upchurch Constr. Co., Montgomery, $46,298. Bids Dec. 4. Noted Dec. 10, C. D.—Nov. 28, E. N.-R.

†**Ala., Fort McClellan**—Con. Q. M., constructing enlisted men's service club, to A. Blair, Montgomery, $150,731.

†**Ala., Fort McClellan**—U. S. Eng., constructing enlisted men's club, gymnasium and assembly hall, to A. Blair, Montgomery, $150,731. Bids Nov. 14. Noted Oct. 23, C. D.—Oct. 31, E. N.-R.

Ala., Tuscaloosa—Tuscaloosa Co. Bd. Educ., Group 1 schools, incl. auditorium addition to Vance School additional room, plumbing and heating at Brookwood, to J. Laycocke, Tuscaloosa, $30,000; Group 2, additional room and plumbing and heating at Gorgas School, 3 room addition to Holly Sorings School, additional rooms at Samantha School, to I. M. Crum, 420 St. Charles Ave., Birmingham, $35,000. P.W.A. Bids Dec. 11. Noted Dec. 9, C. D.

Ala., Mobile — City Comn., 5 story, brick, concrete cold storage plant, 1 story machinery building and steel car sheds, to O. M. Given Constr. Co., Fern St., New Orleans, La., $321,000; equipment, to Doullut & Ewin, Inc., Q & C Bldg., New Orleans, La., $60,787. **P.W.A.** Noted Dec. 12, C. D.

Ala., Tuscaloosa—University of Alabama, 2 story, 55x211 ft., brick engineering shop building, to Skinner & Biederman, $144,500. Bids Dec. 11. Noted Dec. 9, C. D.—Dec. 12, E. N.-R.

Ariz., Flagstaff—State Teachers College, general contract women's dormitory, to P. W. Womack Constr. Co., Phoenix, $152,797; altering heating plant, to Thompson Plumbing & Heating Co., Phoenix, $14,240. **P.W.A.** Bids Oct. 11, awarded Dec. 14. Noted Nov. 7, C. D.—Nov. 14, E. N.-R.

Calif., San Francisco—Dpt. P. Wks., City Hall, mechanical equipment and plumbing for Agassoz School, 22nd and Bartlett Sts., for City and San Francisco Co., to H. Lawson, 465 Tehama St., $24,680; electrical work, to Lynn & Heffernan, 114 Ashton Ave., $17,740. Bids Nov. 27, awarded Dec. 12. **P.W.A.** Rejected bids Nov. 27, general contract for same. Noted Dec. 5, C. D.—Nov. 14, E. N.-R.

Conn., Old Saybrook—Town, G. B. Smith, Bd. Selectmen, 2 story, basement, 40x60 ft., 40x60 ft. and 60x115 ft., brick, steel high school addition and grade school connected by auditorium, to Pieretti Bros., Centerbrook, $143,650. **P.W.A.** Noted Nov. 12, C. D.—Nov. 14, E. N.-R.

†**Conn., Westport**—Treas. Dpt. at office Sup. Archt., Wash., D. C., interior lighting fixtures in U. S. Post Office, to Edwin F. Guth Co., Jefferson and Washington Ave., St. Louis, Mo., $335. Awarded Dec. 20. Sept. 30, C. D.—Oct. 3, E. N.-R.

†**Fla., Fort Lauderdale**—Treas. Dpt. at office Sup. Archt., Wash., D. C., constructing U. S. Post Office, to A. C. Atherton Co., 1791 Howard Ave., Chicago, Ill., $97,000. Bids Nov. 5. Noted Nov. 12, C. D.—Oct. 10, E. N.-R.

Ga., Milledgeville—Bd. Control Elemosynary Institutions, State Capital, Atlanta, constructing central heating plant at State Hospital, to Virginia Eng. Co., Newport News, Va., $246,713. **P.W.A.** Bids Dec. 6, awarded Dec. 6. Noted Nov. 22, C. D.—Nov. 28, E. N.-R.

★ **Ill., Chicago**—Dpt. P. Wks., City Hall, constructing 6 fire stations, one each at Rawson St., Hoxie, North Knox, Eastwood, Barry and North Tripp Aves., to H. A. Hanson Constr. Co., 1851 North Elston Ave., $158,935, $97,000 P.W.A. grant•••5 police stations at Foster, Monterey and Lowe Aves., Sale St. and North Pulaski Rd., to J. Gebhardt & Son, 308 West Washington St., $223,990, $137,612 P.W.A. grant•••3 fire stations, one each at South Parnell Ave., Fulton St. and West Cermac Rd., to H. A. Hanson Constr. Co., 1851 North Elston Ave., $132,000, $87,121 P.W.A. grant•••2 stations, one each at South Dearborn St. and North Kostner Ave., to M. McDermott Co., 53 West Jackson Blvd., $59,968, $35,000 P.W.A. grant. Grand total $587,925. Noted Nov. 19, C. D.

★ **Ill., Rock Island**—Bd. Educ., E. F. Burch, clk., general contract Senior High School, 3 story, basement, 202x535 ft., rein.-con., brick, steel, 15th St. between 23rd and 25th Aves., to Coath & Goss, Inc., 228 North LaSalle St., Chicago, $692,000 base bid. **P.W.A.** Bids Dec. 10.

Ia., Charles City—City, brick, rein.-con. municipal hospital, plain found., general contract, to William O'Neil & Sons, Faribault, Minn., $79,985•••plumbing and heating, to Wheatland Co., Cedar Rapids, $14,785•••electrical work, to Electric Equipment Co., Des Moines, $5,289•••sterilizer, to American Sterilizer Co., Erie, Pa., $3,486•••elevator, to Montgomery Elevator Co., Moline, Ill., $1,890•••dumbwaiter, to Otis Elevator Co., 513 East Mason St., Milwaukee, Wis., $1,060•••temperature control, to Johnson Service Co., Des Moines, $2,839•••4 refrigerators, to Anderson Music House, Charles City, $318•••one refrigerator, to Meusels Hardware Co., Charles City, $125. Grand total $109,777. **P.W.A.** Noted July 30, C. D.—Aug. 1, E. N.-R.

Ia., Clear Lake—Independent School Dist. of Clear Lake, general contract constructing 3 story, basement, to Ernest Anderson, Clear Lake, $97,645•••plumbing and heating, to D. W. Hickey, St. Paul, Minn., $25,422; electrical work, to Pratt Electrical Co., Algona. **P.W.A.** Noted June 27, C. D.

Kan., Shawnee Mission—Bd. Educ. Dist. 6, 3 story, basement, 154x197 ft., brick, stone high school unit, Johnson Co., to Straub & Kelisky, 419 Floyd Bldg., Kansas City, Mo., $158,000. Noted Dec. 2, C. D.—Dec. 5, E. N.-R.

Kan., Topeka—Bd. Educ., constructing East Side Junior High School, to Bowers & Ingram, Topeka, basic bid $252,306•••plumbing, to Beck & Baer, $40,220•••electrical work, to Evans Electrical Constr. Co., 1626 Walnut St., Kansas City, Mo., $17,375. Grand total $309,901. **P.W.A.** Noted Dec. 3, C. D.—Dec. 5, E. N.-R.

Mass., Boston—City, Dpt. School Buildings, 11 Beacon St., Boston, 3 story, basement, 58x116 ft. high school addition, Thos. Park and G Sts., South Boston, to Rugo Constr. Co., 80 Boylston St., $386,221. **P.W.A.** Bids Dec. 11, awarded Dec. 13. Noted Dec. 17, C. D.

Mass., Concord — I. P. Rocheford, general contractors, 8 Arlington Pl., Framingham, heating for gymnasium building on Stow and Hubbard Sts., to R. H. Baker Co., 154 Broadway,

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†*Federal Government.*

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Public Buildings (Continued)

Cambridge, for Town, Bd. Selectmen, H. W. Brown, chn. of Building Comn., Town Hall*** plumbing, to C. H. Cronin, Inc., 14 Byron St., Boston***electrical work, to Alfred C. Senecal Co., Box 35, Westboro. Noted Nov. 22, C. D.—Nov. 28, E. N.-R.

Mass., Georgetown—J. W. Diff & Sons, Inc., general contractors, 146 Summer St., Boston, plumbing for high school, for Town, North St., to J. B. Farnsworth, 153 Tyler St., Boston ***heating, to V. J. Kenneally Co., 251 Causeway St., Boston***electrical work, to Friedman Electric Co., 137 Pearl St., Boston***plastering, to F. A. Connor, 64 Wentworth St., Lowell ***roofing, to Eagle Cornice & Skylight Wks., 197 Sidney St., Cambridge***structural steel and light iron, to Standard Steel & Iron Wks., 165 Walnut St., Watertown***grid flat slab system, to Grid Flat Slab Corp., 761 Dudley St., Dorchester***erecting structural steel, to O. H. Horovitz, 31 Montrose St., Newton*** kalamein, to Metal Clad Doors, Inc., 675 Concord Ave., Cambridge***terrazzo and slate, to Lee Tile Co., 1285 Columbus Ave., Roxbury ***dampproofing, to National Waterproofing Co., 1079 Columbus Ave., Roxbury***doors, windows, inside and outside finish, to Gregg & Son, Crown St., Nashua, N. H. Noted Nov. 20, C. D.—Nov. 28, E. N.-R., under "Contracts Awarded."

Mass., Hathorne (Danvers)—Commonwealth of Massachusetts, Dpt. Mental Diseases, State House, Boston, furnishing, installing fire alarm system at Danvers State Hospital, to Holtzer Cabot Electric Co., 125 Armory St., Jamaica Plain, $23,943. **P.W.A.** Bids Nov. 25. Noted Nov. 19, C. D.—Nov. 21, E. N.-R.

Mass., Medford — City, Mayor J. J. Irwin, F.E.R.A. Administrator in charge, City Hall, 1 story, brick, steel municipal garage, incl. office, repair shop, storage rooms, concrete found., day labor, under supervision of W.P.A. To exceed $40,000. Noted Jan. 4, C. D.—Jan. 10, E. N.-R.

Mich., Battle Creek—Bd. Educ., general contract brick, steel, stone, concrete school, to R. G. Phelps, Battle Creek, $144,500***heating, to Hunter-Prell Co., Battle Creek, $23,482 ***plumbing, to Stephen J. Dempsey Co., Inc., Battle Creek, $11,419***electrical work, to Central Electric Co., Battle Creek, $18,372. Grand total $197,773. **P.W.A.**

Minn., Faribault—State Bd. Control, State Office Bldg., St. Paul, general contract 3 story, basement hospital, School for Feeble Minded, to M. Schumacher, 1015 Baker Bldg., Minneapolis, $275,800***heating, plumbing and ventilating, to P. J. Gallagher & Sons, Faribault, $72,200***electrical work, to Draper Electric Co., Mankato, $30,300***elevators, to Heller Elevator Co., 240 North Milwaukee St., Milwaukee, Wis., $12,786***sterilizer equipment, to Brown & Day, Inc., 62 East 5th St., St. Paul, $4,226. Grand total $395,312. **P.W.A.** Bids Nov. 26. Noted Nov. 12, C. D.—Nov. 21, E. N.-R.

Minn., Glenwood—City, J. H. Thoreson, clk., engines for power plant, to L. A. Kepp Co., Rochester, $62,000; distribution system, to Commonwealth Electric Co., 417 Bway., St. Paul, $59,000. **P.W.A.** Rejected bids Dec. 9, constructing power plant building. Bids Dec. 9. Noted Dec. 2, C. D.

Minn., Luverne—City, R. Fitzer, city recdr., furnishing, installing new Diesel unit and switchboard in present municipal power plant, to Fairbanks Morse Co., Park Sq., St. Paul, $47,914; foundation for addition to power plant is being built, addition by day labor.

†Minn., Minneapolis—P. Wks. Administration, Div. Housing, Wash., D. C., demolishing and disposing of certain buildings on site of Sumnerfield Housing Project, H-4201, to Rose Bros. Lumber & Supply Co., 1221 6th Ave. N., $3,800. Bids Nov. 26. Noted Nov. 19, C. D.

Minn., Minneapolis—State Comn. of Administration & Finance, 120 State Capitol, St. Paul, general contract 3 story, basement, brick, stone adult education building and underground garage, University of Minnesota Campus, to C. F. Haglin & Sons Co., 720 National Bldg., $211,700***heating and plumbing, to Harris Bros. Plumbing Co., 217 West Lake St., $31,650*** wiring, to Commonwealth Electric Co., 417 Bway., St. Paul, $19,672***ventilating, to D. W. Hickey, 1631 University Ave., St. Paul, $8,262. Grand total $271,284. **P.W.A.** Bids Dec. 3. Noted Nov. 22, C. D.—Nov. 28, E. N.-R.

Minn., Moorhead—City, furnishing, installing equipment at municipal power plant, and stoker, to William Bros. Boiler & Mfg. Co., Nicollet Island, Minneapolis, $19,250 and $6,100 respectively. **P.W.A.** Bids Dec. 12. Noted Dec. 3, C. D.—Dec. 5, E. N.-R

Minn., New Ulm—City, A. C. Sannwald, clk., improvements at municipal power plant, incl. furnishing, installing 1 turbo-generator, to Elliott Co., 204 Baker Bldg., Minneapolis, $42,530; one surf condensor, to Foster-Wheeler Corp., 165 Bway., New York, N. Y., $9,192. Noted Nov. 22, C. D.—Nov. 28, E. N.-R.

Minn., Owatonna—State Comn. Administration & Finance, 210 State Capitol, St. Paul, furnishing, installing steam engine generator unit in power plant at State Public School, to Kent-Ervin Eng. Co., 732 Builders Exch., Minneapolis, $10,717. **P.W.A.** Bids Nov. 27. Noted Nov. 13, C. D.—Nov. 21, E. N.-R.

★ **Mont., Butte**—Bd. Educ., A. Leary, clk., general contract 3 story, 200x300 ft. school, Gold and Wyoming Sts., to Lovering-Longbotham Co., 605 Builders Exch. Bldg., St. Paul, Minn., and Pappin & Son, Great Falls, $506,812***plumbing and heating, to Northern Plumbing & Heating Co., Helena, $131,469*** wiring, to Rowe Electric Co., Great Falls, $32,986***painting, to Ellis Paint Co., Butte, $7,934. Grand total $679,201. **P.W.A.** Bids Dec. 14. Noted Nov. 12, C. D.—Nov. 21, E. N.-R.

N. J., Hopewell—Bd. Cumberland Co., Court House, Bridgeton, general contract addition to hospital, to E. Weiler, 254 Liverpool Ave., Egg Harbor, $87,647***plumbing and heating, to Snook & Gerrard, Main Rd., Millville, $7,827 and $11,416 respectively***electrical work, to W. E. Snell, 226 Elmer St., Vineland, $3,223 ***steel and iron, to American Iron Wks., 1455 Broadway, Camden, $9,940. Grand total $120,053. **P.W.A.** Noted Dec. 16, C. D.—Dec. 18, E. N.-R.

N. Y., Arkport—Union Free School Dist. 1, Hornellsville, constructing foundations for school, to F. J. Snyder Co., 245 Main St., Hornell. Total est. $140,000. **P.W.A.** Bids on superstructure later. Bids Dec. 2. Noted Dec. 11, C. D.

N. Y., Buffalo—Bd. Supervs. Erie Co., 2 story addition to Buffalo Eye and Ear Industry and Wettlaufer Clinic on Maple St. Owner builds and purchases all materials. To exceed $105,000. P.W.A. project. Private plans.

N. Y., Dansville—Bd. Educ., excavating and foundations for school, to Swarthout & Rawley, 548 Mount Hope Ave., Rochester. Total est. $125,500. **P.W.A.** Noted Dec. 2, C. D.—Nov. 14, E. N.-R.

†N. Y., New York—Treas. Dpt. at office Sup. Archt., Wash., D. C., constructing elevator in Postal Station B, to Warsaw Elevator Co., Warsaw, $6,428. Bids Oct. 21. Noted Sept. 30, C. D.—Oct. 3, E. N.-R.

N. Y., Troupsburg—Troupsburg Central School Dist., foundations, excavation for school, to Custer Eng. Co., Terminal Bldg., Bradford, Pa. Total est. $143,626. **P.W.A.** Bids on superstructure later. Bids Dec. 2. Noted Dec. 10, C. D.

N. C., Winston Salem—Forsyth Co. Home, J. G. Hanes, chn. Bd. Comrs., general contract county home, to Fowler-Jones Constr. Co., Winston Salem, $151,270***heating, to Reliance Eng. Co., 1101 Providence Rd., Charlotte, $19,338***plumbing, to J. L. Powers, Bennettsville, S. C., $20,933***pumps and water tank, to Kester Mchy. Co., Winston Salem, $4,495. Grand total $196,036. Noted Dec. 5, C. D.—Oct. 10, E. N.-R.

N. D., Devils Lake — City, excavation and footings, 3 story, basement school, to Fjeldseth & Johnson, Devils Lake, $7,735. Total est. $300,000. **P.W.A.** Bids Dec. 14. Noted Dec. 9, C. D.

N. D., Dickinson—Stark Co., excavation, footings and foundation for 3 story, basement, 98x120 ft., rein.-con., brick, tile, Bedford stone court house and jail, to S. W. Jonason & Co., Aberdeen, S. D., $9,450. Total est. $175,000. **P.W.A.** Bids on superstructure later. Noted Dec. 2, C. D.—Dec. 5, E. N.-R.

N. D., Grafton—State Bd. Administration, E. G. Wannet, secy., Capitol, Bismarck, excavation and foundations for 4 story, basement, 39x183 ft. dormitory with two 24x82 ft. units at ends of main building at State School, to Johnson-Gillanders, Grand Forks, $8,630. **P.W.A.** Bids Dec. 14. Noted Dec. 2, C. D.—Dec. 5, E. N.-R.

N. D., San Haven—Bd. Administration, E. G. Wanner, secy., Capitol Bldg., Bismarck, general contract 6 story, 46x174 ft., brick, steel infirmary, State Tuberculosis Sanitarium, to Meinecke-Johnson Co., 11 Bway., Fargo, $189,886. **P.W.A.** Bids Dec. 9. Noted Nov. 22, C. D.—Nov. 28, E. N.-R.

O., Cleveland—Pub. Library Bd., general contract constructing addition to garage and storage building, to Hadlock Krill Co., 3646 Euclid Ave., $135,401. **P.W.A.** Noted Dec. 2, C. D. —Dec. 5, E. N.-R.

O., Cincinnati—City, 2 story, basement, brick, stone, concrete, steel constructed art museum building, to Ferro Concrete Constr. Co., 4th and Elm Sts., $200,000. Noted Sept. 27, C. D.—Oct. 3, E. N.-R.

O., Dayton—Bd. Educ., general contract 1 and 2 story, brick, concrete addition to Kiser School, to C. H. Shook, Inc., 582 West 2nd St., $49,568***heating and plumbing, to H. J. Osterfeld Co., 415 South Main St., $10,696 ***brick, stone, steel addition to Stiver and Hearthstone Schools, to I. F. Weber Co., Commercial Bldg., $43,875 and $44,925 respectively ***plumbing and heating for Stivers School, to Wood-Daum Co., Dayton, $8,984. Grand total $158,048. **P.W.A.** Noted Nov. 12, C. D.—Nov. 14, E. N.-R.

O., Jamestown—Silver Creek Twp. Bd. Educ., c/o R. E. Turner, constructing 2 story, basement, 16 classroom high school building, and elementary grades, brick, concrete, plain found., to A. P. Eveland, Wilmington, $126,696; steam heating, to Richards-McNoir Co., 666 North Limestone St., Springfield, $16,646. **P.W.A.** Grunkmeyer & Sullivan, Cincinnati, archts.

O., Massillon—Bd. Trustees Pub. Library Bd., constructing 2 story, basement library, to P. Snyder, 2202 Main St., $190,000. Est. $210,000. **P.W.A.** Albrecht & Wilhelm, McClymond Bldg., archts. Awarded Dec. 13. Noted Nov. 26, C. D.—Dec. 5, E. N.-R.

†Okla., Enid—P. Wks. Administration, Div. Housing, Wash., D. C., foundations for Enid Federal Housing Project, to Asplund Constr. Co., Enid, $34,987. Bids Dec. 9. Noted Dec. 13, C. D.—Nov. 28, E. N.-R.

Okla., Oklahoma City—City, general contract 4 story, basement, brick, rein.-con. jail, plain found., Walker St., to C. M. Dunning Co., 424 North Hudson St., $191,147. **P.W.A.** Noted Dec. 19, C. D.—Dec. 26, E. N.-R.

Okla., Stillwater—Bd. Affairs, Capitol, Oklahoma City, awarded contract girls' dormitory at A. & M. College, to Holmboe Constr. Co., 211 West 4th St., Oklahoma City, $151,010. **P.W.A.**

†Pa., Phila.—Treas. Dpt. at office Sup. Archt., Wash., D. C., constructing Kingsessing Post Office, 52nd St. and Whitby Ave., to M. and L. Constr. Co., 40th and Chestnut St., $73,872. Bids Sept. 25. Noted Sept. 27, C. D.—Sept. 12, E. N.-R.

Pa., Pittsburgh—Bd. Educ., Administration Bldg., general contract first section of Alice M. Carmalt School, to Wm. S. Miller Co., 2565 5th Ave., $93,000***heating and ventilating, to Moss & Blakely, 223 Bletzhoover Ave., $16,219***plumbing, to W. N. Sauer Co., 806 Chestnut St. N.S., Pittsburgh, $8,950***electrical work, to Stauffer Electric Co., West Liberty Ave., $7,860***boilers, to American Radiator Co., Manufacturers Bldg., $1,790***temperature regulation, to Johnson Service Co., 1238 Brighton Rd., $1,090. Grand total $128,909. **P.W.A.**

★ **Pa., Reading**—School Dist., 8th and Washington Sts., for Junior High School, 3 story, basement, 170x210 ft., brick, steel, plain found., Chestnut St., to Edward A. Reider, 1504 Alsace Rd., $499,882. **P.W.A.** Awarded Dec. 17. Noted Jan. 23, C. D.—Jan. 31, E. N.-R.

S. C., Clemson College—Clemson Agricultural College, Dr. Sikes, pres., constructing new agricultural classroom building, to Potter & Shackleford, Greenville, $269,019. **P.W.A.** Noted Nov. 19, C. D.—Nov. 21, E. N.-R.

S. C., Clemson College—College Bd., Dr. Sikes, pres., constructing barracks, to Daniel Constr. Co., Anderson, $320,800. **P.W.A.** Noted Nov. 25, C. D.—Nov. 28, E. N.-R.

S. C., Columbia—Richland Co. constructing new court house, to J. C. Heslep, Carolina Band Bldg., $249,500. Noted Dec. 5, C. D.

S. C., Darlington—School Bd., constructing addition to school, incl. gymnasium and auditorium to Mechanics Contg. Co., Columbia, $111,987. **P.W.A.** Noted Dec. 13, C. D—Dec 19, E. N.-R.

S. D., Mitchell—Bd. Educ., general contract two 2 story, basement, brick, steel additions to schools, to P. Kuipers, Mitchell, $109,994 and $44,697 respectively. **P.W.A.** Bids Dec. 12. Noted Dec. 9, C. D.

†Tennessee — Tennessee Valley Authority, Knoxville, furnishing switchgear at Wheeler Power Plant, to Westinghouse Electric & Mfg. Co., Gulf Bldg., Pittsburgh, Pa., $41,000. Bids Oct. 19. Noted Aug. 30, C. D.—Sept. 5 E. N.-R.

Va., Harrisonburg—State Teachers College, Harrisonburg, constructing school, to Harrison Building & Supply Co., Harrisonburg. Est. about $130,000. **P.W.A.**

Wash., Arlington—School Dist., 3 story, 140x204 ft. school, to N. McDonald, Lloyd Bldg., Seattle, $148,122***plumbing and heating, to A. J. Blythe Plumbing & Heating Co., 1313 Railroad Ave., Bellingham, $29,654***electrical work, to Maritime Electrical Mchy. Co., 913 Western Ave., Seattle, $8,825. Grand total $186,601. Est. $185,000. **P.W.A.** Noted Dec. 16, C. D.—Dec. 19, E. N.-R.

Wash., Ellensburg — State, 2 story normal school building, auditorium seating capacity 1,000, containing classrooms, shops, stage equipment, pipe organ, to Roberts & Johnson, 1109 Commerce St., Tacoma, $175,332***mechanical work, to A. G. Rushright, 407 Southcast Morison Ave., Portland, $37,172***electrical work, to NePage McKenny, 204 6th Ave. S., Seattle, $13,064. Grand total $225,568. Noted Nov. 22, C. D.—Nov. 28, E. N.-R.

Wash., Kennewick — School Dist., 2 story, basement, 138x228 ft. school, to Standard Constr. Co., Washington Bldg., Tacoma, $93,856***plumbing and heating, to C. R. Morton, 408 South 18th St., Yakima, $26,226***electrical work, to Thordarson Electric Co., 518 Denny Way, Seattle, $4,970. Grand total $125,052. Est. $125,454. **P.W.A.** Noted Dec. 9, C. D.

W. Va., Huntington—Marshall College Officials, constructing 2 dormitories at Marshall College, to Consolidated Eng. Co., 20 East Franklin St., Baltimore, Md., $300,570.

Wis., Antigo—Bd. Educ., wrecking, excavating and foundations for vocational school addition, to Maas Bros., Watertown, $11,062. **P.W.A.** Bids Dec. 13, awarded Dec. 13. Noted Dec. 6, C. D.

Wis., Milwaukee — Bd. School Directors, plumbing and sewerage for Tippecanoe School, 2 story, basement, 78x153 ft., brick, steel, to Stolhr & Landon, Inc., 1705 West Clybourn St., $12,329***heating, ventilating and stoker, to Wenzel & Henoch, 1524 North 27th St., $33,453***electrical work, to Stenz Electric Co., 924 North Edison St., $11,769. Grand total $57,551. **P.W.A.** Bids Dec. 10, awarded Dec. 12. G. E. Wiley, c/o owner, archt.

Wis., Stanley—School Dist. 3, R. E. Malone, excavation for high school addition, to L. G. Arnold, Inc., Eau Claire, $1,183. **P.W.A.** Bids Dec. 10, awarded Dec. 10. Klinger & Becker, Amery, archts.

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†Federal Government.

Public Buildings (Continued)

Man., Winnipeg—City of Winnipeg Hydro-Electric System, 55 Princess St, constructing one 10,000-kva. generator, for Slave Falls plant, to Swedish General Electric Co. Ltd., Toronto, Ont., $131,100; one hydraulic turbine, to Dominion Eng. Co. Ltd. Toronto, Ont., $83,875. Noted Oct. 21, C. D.—Oct. 24, E. N.-R.

N. S., Halifax—Foundation Maritime Co. of Canada Ltd., general contractors, mail chutes for public buildings, for Dpt. P. Wks., Ottawa, Ont., to Boiler Sales Co., 222 Hollis St.; painting, to Martin & Moore, 653 Barrington St. Noted Nov. 15 C. D.—Nov. 21, E. N.-R.

COMMERCIAL BUILDINGS

PROPOSED WORK

N. Y., Brooklyn—Brooklyn Hebrew Home & Hospital for Aged plans by W. I. Hohauser, 1841 Bway., altering 6 story home, 813 Howard Ave. $350,000.

N. Y., Buffalo—E. W. Goldstein, archt., 1 Allen St., soon lets contract 2 story, basement, 50x100 ft. department store, incl. heating, plumbing, electrical work, sprinkler, elevator, Bway., for Kobackers Department Store, 1 Allen St. To exceed $105,000.

N. Y., Flushing—Sieglin Co., 60 East 42nd St., plans group dwellings on 300 lots. 194th St. and 48th Ave. To exceed $100,000. Site acquired.

★ **N. Y., Kew Gardens**—East New York Savings Bank, Atlantic and Pennsylvania Aves., bids after Mar. 1, constructing apartments, Metropolitan Ave. and Park Lane. $750,000. B. Braunstein, 162-18 Jamaica Ave., Jamacia, archt. Noted July 10, C. D.—July 18, E. N.-R.

BIDS ASKED

N. Y., Scarsdale—See "Contracts Awarded."

CONTRACTS AWARDED

N. J., Teaneck—McCabe Realty Corp., Inc., Wilson Ave. and Wyndham Rd., group of dwellings, Wilson Ave., day labor and separate contracts. To exceed $100,000. Noted Dec. 12, E. N.-R.

N. Y., Flushing—St. Marys Parish, H. Lynch, pastor, 146-41 Jamaica Ave., general contract school and rectory, to Patrick Constr. Co., 464 5th Ave., Brooklyn. Est. $150,000. Separate contracts now being awarded. Noted Oct. 18, C. D.—Oct. 24, E. N.-R.

N. Y., Scarsdale — Mayfair Meadows, c/o Everett Jacobs, Fox Meadows, Scarsdale, constructing group dwellings, Harney Rd. near Bronx River Parkway, day labor and separate contracts. $100,000 or more. H. I. Feldman, 15 West 44th St., New York, archt. Noted Dec. 9, C. D.—Dec. 12, E. N.-R.

Que., Hull—Ed. Brunet & Son, general contractors, cut stone for sanatorium, Aylmer Rd., for Sisters of the Cross, to Arco Stone Co., 2565 Belanger St. E., Montreal***brick chimney, to Francis Hawkin & Co., 2028 Union St., Montreal***boilers, to Babcock-Wilson & Goldie-McCulloch Ltd., 610 Cathcart St., Montreal. Noted Nov. 27, C. D.—Dec. 5, E. N.-R.

INDUSTRIAL BUILDINGS

PROPOSED WORK

Ala., Birmingham—MACHINE SHOPS—Illinois Central R.R., 135 East 11th Pl., Chicago, Ill., St. Louis & San Francisco R.R., St. Louis, Mo., F. G. Jonah, ch. engr., and Central of Georgia Ry., R. R. Cummins, genl. mgr. and ch. engr., Savannah, Ga., plan reconditioning and consolidation of railway machine shops. To exceed $40,000.

Arizona—GOLD MINING DEVELOPMENT—Sterling Gold Mining Corp., c/o J. A. Hamilton, Cordes, plans mining development. To exceed $100,000.

Calif., Chico—BREWERY—P. Marinoff, c/o L. B. Osborn, secy., Chamber of Commerce, plans brewery in area south of State Highway. $150,000—$200,000. Architect not appointed.

N. Y., Oneonta—FACTORY—Otsego Forest Products Assn. plans factory. $65,000. Private plans.

★ **N. Y., Yonkers**—FLOUR MILL—Corporation, c/o A. M. Kahn, 15 Park Row, New York, plans altering former Spreckles Sugar Refinery into flour milling and storage. $1,000,000. **Maturity after Feb. 1.**

W. Va., Warwood—PLANT—Ackerman Mfg. Co., River Rd., plans addition to plant. $50,000.

★ **Que., Montreal**—PLANTS—Grant Eng. Co., 1164 Beaver Hall Sq., Montreal, Que., J. H. Purkness, secy., purchases sites for processing plants at Montreal, Que., Kitchener, Ont. and Owen Sound, Ont. to manufacture Seminole from Canadian and bituminous coal and lignite. To exceed $1,000,000. **Maturity in spring.**

Ky., Frankfort—WAREHOUSES—Sanderson & Porter, engrs., 52 William St., New York, bids about Jan. 20, distillery extensions and improvements, for E. H. Taylor Distillery, c/o National Distillers, Frankfort and 120 Bway., New York. $250,000. Noted Nov. 18, C. D.—Nov. 21, E. N.-R.

BIDS ASKED

Calif., Long Beach—FACTORY—See "Contracts Awarded."

Mich., Detroit—STORAGE—Murray Corp. of America, 1424 Aberle St., taking bids general and separate contracts addition to Plant 10. Giffels & Vallet, 1000 Marquette Bldg., archts. Noted Oct. 3, C. D.—Oct. 10, E. N.-R.

Nova Scotia — MINING — See "Contracts Awarded."

Ont., St. Catherines—FOUNDRY—McKinnan Industries Ltd., taking bids constructing 322x300 ft. foundry, 1 story, 66x120 ft., brick, steel power house, plain found., air compressor, switchboard, Ontario St. To exceed $100,000. A. E. Nicholson, 46 Queen St., archt.

CONTRACTS AWARDED

Calif., Long Beach—FACTORY—Spencer-Kellog & Sons, Niagara Square, Buffalo, N. Y., plans to be completed about Feb. 1, linseed oil plant on 6 acre site, incl. mill building, refinery, boiler house, office building, warehouse grain elevator and wharf, Cerritos Ave., Channel. To exceed $150,000. Work will be started on day labor basis under supervision of Wm. J. Moran, structural engr., 1011 South Fermont St., Alhambra. Noted Dec. 18, C. D.—26, E. N.-R.

Colo., Denver — DISTRIBUTION PLANT — Dental Specialty Co., 1215 20th St., distribution building, to N. G. Petry Co., Denham Bldg. **Est. $35,000.**

La., Marrero — CHEMICAL PLANT — Paper Makers' Chemical Co., Kalamazoo, Mich., plant, to Industrial Eng. & Constr. Co., Hibernia Bank Bldg., New Orleans. Est. $60,000.

Md., Baltimore—PLANT—Mutual Chemical Co. of America, Block and Willis Sts., plant addition, to Maryland Metal Building, Race and McComas Sts. $40,000.

Mass., Framingham — FACTORY — Hodgman Rubber Co., Herbert St., 2 story, basement, 60x109 ft., brick, steel, concrete factory addition Building 8, Herber St., to J. J. Convisor, 333 Washington St., Boston. To exceed $28,500. I. Richmond, 248 Boylston St., Boston, archt.

Mass., Salem—BUS GARAGE—Eastern Massachusetts Street Railway, Maintenance Dpt., 38 Chauncy St., Boston, painting 1 story, 122x180 ft., bus garage, to R. Tweed & Son, 45 Dudley St., Roxbury; roofing, to Eagle Cornice & Skylight Wks., 197 Sidney St., Cambridge. Noted Nov. 8, C. D.

N. Y., Buffalo—PLANT—Molin Corp., Crosby Bldg., general contract warehouse, shipping room, to Metager Constr. Corp., 429 Carlton St.; heating, to Quackenbush & Co., 597 Michigan Ave., Buffalo. Est. exceeds $105,000. Noted Dec. 2, C. D.—Dec. 5, E. N.-R.

N. Y., Buffalo—PLANT—John W. Cowper Co., general contractors, Rand Bldg., roofing for plant addition, Clinton St., for Worthington Pump & Mchy. Corp., Harrison, N. J., to Carey Co., 1174 Niagara St. Total est. $175,000. Noted Nov. 15, C. D.—Nov. 21, E. N.-R., under "Contracts Awarded."

N. Y., Rensselaer—FACTORY—W. G. Sheehan Constr. Co., general contractors, 28 DeWitt St., Albany, painting factory addition, Riverside Ave., for General Aniline Wks., Inc., Riverside Ave., to J. L. Clark, 191 Bway., Rensselaer; metal lathing and plastering, to T. J. Bell Co., Valatie. Total est. $100,000. Noted Nov. 26, C. D.—Dec. 5, E. N.-R.

O., Cleveland — FACTORY — Musterole Co. (Medicinal Supplies), 1748 East 27th St., G. H. Miller, secy., constructing 3 story, basement, 30x70 ft. factory addition, 1748 East 27th St., to S. W. Emerson Co., 1836 Euclid Ave. Est. $40,000. Awarded Dec. 16.

Pa., Pittsburgh—WAREHOUSE—Baltimore & Ohio R. R., Baltimore and Charles Sts., Baltimore, Md., 1 story banana warehouse, brick, steel, 21st St., to Rust Eng. Co., Clark Bldg. Est. $50,000. L. P. Kimble, Baltimore, Md.

Va., Newport News — PLANT — Coca Cola Bottling Co., 3200 Huntington Ave., constructing addition to plant, separate contracts awarded. Est. $30,000 or more.

Va., Roanoke—GRAIN ELEVATOR, etc.—Roanoke City Mills, Roanoke, constructing grain elevator and storage, separate contracts awarded. To exceed $30,000.

W. Va., South Warwood—PLANT—Continental Can Co., 1 Pershing Square, New York, plant addition, to Austin Co., 19 Rector St., New York. Est. $50,000.

Wis., LaCrosse — INDUSTRIAL — LaCrosse Supply Co., 125 South 6th St., general contract 1 story, 48x90 ft., steel, concrete, brick addition, plain found., to T. Molyahn & Sons, LaCrosse.

Nova Scotia—MINING—United Gold Fields of Nova Scotia Ltd., c/o D. W. MacKay, Liverpool, mining development in various locations, day labor and separate contracts. To exceed $100,000. Noted Nov. 26, C. D.—Dec. 5, E. N.-R.

★ **Ont., Hamilton**—FACTORY—Steel Co. of Canada Ltd., Harvey Lane, 1 story brick, steel factory, plain found., Harvey Lane, owner does masonry and carpentry work, will sub-let trades and purchase materials as required. Est. $750,000. Private plans.

Que., St. Johns — FACTORY — Schick Dry Shaver, Inc., 644 Atlantic St., Stamford, Conn., constructing factory, to Pierre Trachan, St. Johns, $50,000.

†*Federal Government.*

Constr. News page 11

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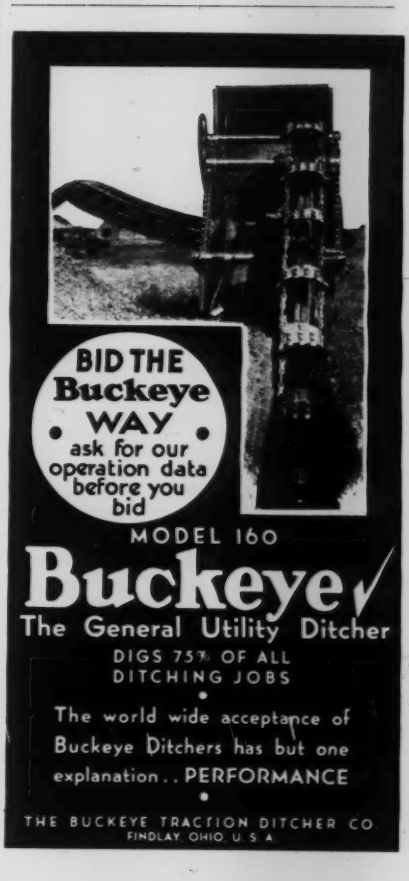
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